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ASSESSMENT OF THE CAPACITY OF THE AUTOMATED RADAR TERMINAL SYST--ETC(U)

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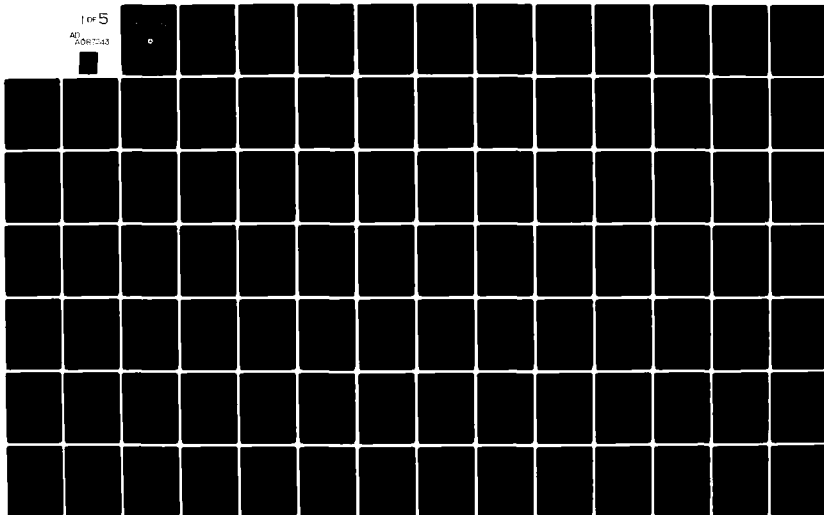
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Report No. FAA-RD-80-51

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ASSESSMENT OF THE CAPACITY OF THE AUTOMATED RADAR TERMINAL SYSTEMS (ARTS IIIA) FOR THE YEARS 1980-1990

William Pailen
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Sterling Systems, Incorporated
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FINAL REPORT

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Automatic Radar Terminal Systems

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16. Abstract The capability of the ARTS IIIA to support future air traffic growth and functional enhancements through 1990 is examined. The approach used is to investigate a few high traffic density sites which are representative of the three current terminal system configurations: single sensor sites (Detroit); dual sensor sites (Chicago, Los Angeles); and Metroplexes (New York). Loading factors are determined for each model site. These factors include the number and type of sensors and displays, the instantaneous traffic counts, and functional capability. The loading parameters are then used as inputs to a processing model, developed in this study, in order to determine if the ARTS IIIA can provide adequate processing capacity. The loading parameters are also used to develop estimates of memory requirements. The results of the study indicate that processing capacity limitations, if not overcome, will likely constrain functional growth at Metroplex facilities but will present no problems for single and dual sensor sites. Current memory capacity limitations are shown to present significant problems for both Metroplexes and dual sensor sites.		
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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures				Approximate Conversions from Metric Measures			
Symbol	When You Know	Multiply by	To Find	Symbol	When You Know	Multiply by	To Find
LENGTH				LENGTH			
in	inches	2.5	centimeters	mm	millimeters	0.04	inches
ft	feet	30	centimeters	cm	centimeters	0.4	inches
yd	yards	0.9	meters	m	meters	3.3	feet
mi	miles	1.6	kilometers	km	kilometers	0.6	miles
AREA				AREA			
sq in	square inches	6.5	square centimeters	cm ²	square centimeters	0.16	square inches
sq ft	square feet	0.09	square meters	m ²	square meters	1.2	square yards
sq yd	square yards	0.8	square meters	m ²	square kilometers	0.4	square miles
ac	acres	2.6	square kilometers	km ²	hectares (10,000 m ²)	2.5	acres
MASS (weight)				MASS (weight)			
oz	ounces	28	grams	g	grams	0.035	ounces
lb	pounds (2000 lb)	0.45	kilograms	kg	kilograms	2.2	pounds
		0.9	tonnes	t	tonnes (1000 kg)	1.1	short tons
VOLUME				VOLUME			
teaspoon	teaspoons	5	milliliters	ml	milliliters	0.03	fluid ounces
fluid oz	fluid ounces	30	milliliters	ml	liters	2.1	pints
cup	cups	0.24	liters	l	liters	1.06	quarts
pt	pints	0.47	liters	l	cubic meters	0.26	gallons
qt	quarts	0.95	liters	m ³	cubic meters	35	cubic feet
gal	gallons	3.8	liters	m ³	cubic meters	1.3	cubic yards
cu ft	cubic feet	0.03	cubic meters				
cu yd	cubic yards	0.76	cubic meters				
TEMPERATURE (exact)				TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature

*1 in. = 2.54 centimeters exactly. For other exact conversions and more detailed tables, see NBS Mon. Publ. 786, Units of Weights and Measures, Pt. 2, 1975, SD Catalog No. C13.110-786.

NOTE

This report is intended only to provide an approximate indication of the capability of the ARTS IIIA to support future processing and storage requirements and should not be used to determine the precise hardware configuration that should be implemented at any particular site. All processing and memory requirements estimates contained in this report are based on the New York ARTS IIIA program architecture.

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1.0 SUMMARY

The analysis approach for this study was designed to provide insight into the capability of the ARTS IIIA to support anticipated processing demands at three types of terminal facilities:

- Metroplex configuration (New York TRACON)
- High density dual sensor sites (Chicago and Los Angeles)
- High density single sensor sites (Detroit)

The future processing and storage requirements throughout the year 1990 were analyzed for the model sites shown in each category above. It is assumed that any capacity limitations evident at Chicago and Los Angeles would be similar in severity and expected time of occurrence to those that should be expected at other dual sensor sites with high traffic densities. Similarly, the analysis results for Detroit are assumed representative of those expected for single sensor sites with high traffic densities. The New York TRACON, currently in the implementation phase, is the only existing metroplex configuration. The FAA, however, is considering the use of metroplex configurations at other locations such as San Diego, Oakland and Washington, D.C. The analysis results for New York provide insight into the ability of the ARTS IIIA to support the requirements of large metroplex facilities.

The study results indicated that the processing capacity of the ARTS IIIA will be adequate for dual and single sensor sites throughout the period of the study. The processing capacity of the New York system, however, appears only marginally to meet the demands starting in 1984, with strong indications of an overload if Metering & Spacing (M&S) is installed before the Discrete Access Beacon System (DABS). The demand for storage is expected to equal or exceed system capacity at all high traffic density sites, except single sensor sites. Storage saturation is expected in 1982 at New York with the implementation of Conflict Alert. At dual sensor sites with high traffic densities, saturation is expected to occur in 1986, as M&S is introduced.

Processing and storage requirements at ARTS IIIA facilities are determined by the peak instantaneous traffic counts, system hardware configurations, and processing functions performed at each site. Thus, in order to estimate the current and future processing and storage requirements it was first necessary to identify the environmental and functional characteristics of the selected model sites.

Estimates of peak instantaneous traffic counts were developed by examining reported and projected airport operations at facilities within the coverage area of the ARTS surveillance systems. Busy hour instantaneous traffic estimates were developed for each model site by establishing a busy/average hour ratio of airport operations and applying it to forecasts of average hour operations for the years 1980 to 1990. Instantaneous traffic estimates were then derived from the busy hour estimates. Computation of the instantaneous traffic count was based upon estimates of the average speed, average altitude and radius of surveillance coverage for each general category of aircraft, as well as distance from the surveillance system to the airport of operation for the aircraft.

Determination of the current and future hardware configurations at the four model sites primarily involved the identification of the number and type of displays and sensors. The number of control room displays was estimated to increase in proportion to the projected growth of air traffic. Also it was assumed that remote tower cab displays will be implemented by 1984 at airports that have control towers and are within 20 nm of ARTS IIIA facilities. ARTS IIIA sensors are assumed to be ASR-8 and ATCBI-4 or 5 initially. These sensors are expected to be replaced with DABS by 1985 at Chicago, Los Angeles, and Detroit and by 1988 at New York.

The functional capabilities at each model site for 1980 are the standard ARTS IIIA/New York TRACON capabilities currently being implemented. Future functional growth is expected to include Conflict Alert (CA), Metering and Spacing (M&S), ARTS/DABS integration, ARTS/Terminal Information Processing System (TIPS) interface, Full Digital ARTS Displays (FDAD) and Tower Cab

Digital Displays (TCDD). The assumed implementation dates are:

CA	1982
M&S	1985
DABS	1985 (Chicago, LA, Detroit)
	1988 (NY)
TIPS	1983
FDAD	1984
TCDD	1983

Having determined the environmental and functional characteristics of each model site, processing and storage models were developed in order to determine the system requirements.

The processing model consisted of three parts: a scheduler model, task timing models, and lattice descriptions.

The scheduler model is a FORTRAN program which simulates the ARTS IIIA method of initiating processing activities. Three types of processing activities are scheduled: planned tasks, popup tasks, and overhead. Planned tasks are initiated by the scheduler according to a set of precedence relationships described in a lattice structure and according to availability of processors. Popup tasks occur asynchronously with the lattices and planned tasks and may be scheduled periodically or activated at random intervals.

Task timing models are mathematical equations that relate system load parameters to the amount of processing time required by individual task. Models of processing times for existing planned and popup tasks and for overhead activities are based upon analysis of results of timing measurements taken at the New York TRACON and the System Simulation Facility at NAFEC. Live aircraft traffic returns constituted the system load for two of the measurements runs and simulated traffic returns were used for the remaining runs. Data collected in all runs consisted of time expended in each planned and popup task, as well as in overhead, dead time, and idle time. At the

same time, counts were taken of the quantities of radar and beacon target reports, associated and unassociated tracks, display symbols of various types, and other system variables. In addition, the mean variance, maximum, and minimum time were recorded for each task in each run. The mean lattice times, and the percentages of time spent by each processor in planned tasks, popup tasks, overhead, dead time, and idle time were also recorded.

For those tasks exhibiting large mean times or large variances, attempts were made to characterize the processing times as linear functions of some of the system variables, using multiple linear regression analysis. Where linear relationships were established, they became the models for the processing times for the tasks for the year 1980. Where regression analysis failed to establish linear relationships, and where the measured mean times and variances were small, the process times were modeled by use of the means and variances obtained from the system measurements. In some cases, however, analysis of the design of the software for a particular task led to the conclusion that the processing time depended on a parameter which did not vary during the measurement runs. In those cases, the process time models were adjusted to reflect the dependence.

The lattice model for the New York TRACON for the year 1980 is the one which existed at New York at the time of the system measurements. Lattice models for Chicago, Los Angeles and Detroit ARTS IIIA systems in 1980 are modified versions of the New York lattice.

Storage requirements estimates for 1980 for New York, Chicago, Los Angeles, and Detroit are generally based upon the storage allocation formulas used in the New York system in the fall of 1979. The 1980 storage requirement estimates are given as a range of values for each site. The range is based upon the assumed range of track capacity requirements.

For the years 1982 and later, storage, lattice, and processing time models were all modified to account for the impact of the planned implementation of advanced functions: Terminal Conflict Alert (CA), Terminal Metering and Spacing (M&S), ARTS/DABS integration, ARTS/TIPS interface, Full Digital

ARTS Display (FDAD), and Tower Cab Digital Displays (TCDD).

Changes in ARTS IIIA processing and storage utilization in the period 1980 to 1990 are expected to be influenced primarily by the implementation of new functional capabilities and system interfaces. Large increases in processor and memory utilization are required for incorporation of Conflict Alert (CA) and Metering and Spacing (M&S). The implementation of FDAD is also expected to increase processing and storage requirements. Keyboard input processing should decrease, but this will be more than offset by the substantial increase in display processing required to generate all-digital symbology. The addition of TCDDs to ARTS IIIA's will require the addition of remote display/keyboard processing tasks at facilities not already having these programs and will thus increase memory and display processing requirements. The Terminal Information Processing System is expected to require a substantial amount of memory, but will have little impact on processing. DABS implementation is assumed to eliminate the need for track correlation processing in ARTS. Thus DABS will reduce total processing requirements but will have little impact on storage demands.

The level of traffic density at each site is a major factor in the determination of initial resource requirements, and also has a large influence on the initial impact of the implementation of advanced functions. However, growth in traffic density is not projected to be great enough at any of the sites studied to cause significant changes in the requirements for processing time or memory capacity from 1980 to 1990.

The following tables present the estimated track capacity, memory and processor requirements for each model site during a busy hour. The tables present the system requirements based on two levels of assumed traffic load. "Level C" represents the higher traffic load assumptions and "Level B" represents the lower. The current system capacity is 7 Input/Output Processors (IOPs) and 14 Memory Modules (MMs) in a failsafe configuration. In a fail-soft configuration, there can be up to 8 IOPs and 15 MMs.

TABLE 1-1 ESTIMATES OF TOTAL TRACK CAPACITY REQUIREMENTS

		LEVEL C				LEVEL B			
		Associated Tracks	Unassociated Tracks	Flight Plans	Total Track Capacity	Associated Tracks	Unassociated Tracks	Flight Plans	Total Track Capacity
NY	1980	76	1491	76	1643	76	961	76	1113
	82	76	1541	76	1693	76	1000	76	1152
	84	80	1584	80	1744	80	1033	80	1193
	86	84	1615	84	1783	84	1055	84	1224
	88	88	1641	88	1817	88	1076	88	1252
LA	90	88	1665	88	1841	88	1098	88	1274
	1980	50	772	50	872	50	533	50	633
	82	54	780	54	888	54	534	50	642
	84	55	800	55	910	55	558	55	668
	86	56	813	56	925	56	567	56	679
CHI	88	60	823	60	943	60	575	60	695
	90	63	830	63	958	63	583	63	709
	1980	53	596	53	702	53	375	53	481
	82	55	617	55	727	55	390	55	500
	84	56	637	56	749	56	405	56	517
DET	86	59	651	59	769	59	415	59	533
	88	58	661	58	777	58	424	58	540
	90	59	670	59	788	59	431	59	549
	1980	44	502	44	590	44	306	44	394
	82	46	520	46	612	46	316	46	408
	84	47	541	47	635	47	331	47	425
	86	48	556	48	652	48	342	48	438
	88	51	568	51	670	51	349	51	451
	90	54	671	54	679	54	352	54	460

TABLE 1-2 LEVEL C STORAGE ESTIMATES

	YEAR	BASIC PROGRAM	BASIC DATA BASE	CA	TIPS	FDAD	M&S	DADS	TOTAL	MM
NY	1980	85,640	135,242	81,141	24,113	24,299			220,882	14
	1982	85,640	139,931	84,865	24,533	24,544			306,712	19
	1984	85,640	144,772	87,695	24,533	24,544	63,440		363,689	23
	1986	85,640	151,292	90,160	24,893	24,772	66,020	5,000	437,144	27
	1988	85,640	150,154	92,158	25,181	24,940	67,740	5,000	446,639	28
LA	1980	80,920	67,806	32,299	14,405	13,993	49,680		148,726	10
	1982	80,920	68,975	33,106	14,573	14,091	51,830		182,194	12
	1984	82,690	73,430	33,799	14,741	14,225	53,980	5,000	217,624	14
	1986	82,690	72,030	34,460	14,885	14,309		5,000	271,863	17
	1988	82,690	74,812	35,050				5,000	277,758	17
CHI	1980	80,920	66,225	25,028	12,461	12,904	50,110		281,373	18
	1982	80,920	67,525	25,887	12,665	13,023	50,110		147,145	9
	1984	82,690	72,626	26,595	12,773	13,086	49,680	5,000	173,473	11
	1986	82,690	71,448	26,975	12,893	13,156	50,540	5,000	206,568	13
	1988	82,690	71,775	27,400				5,000	261,531	16
DET	1980	80,620	49,530	20,962	11,201	9,906	44,950		261,979	16
	1982	80,620	50,466	21,769	11,393	10,018	46,240		263,883	17
	1984	83,070	56,557	22,368	11,573	10,141	47,960	5,000	130,150	8
	1986	83,070	56,617	22,939	11,645	10,183		5,000	152,048	10
	1988	83,070	58,380	23,170				5,000	182,503	12
	1980	83,070	58,789						233,416	15
	1990								237,343	15
									239,817	15

TABLE 1-3 LEVEL 3 STORAGE ESTIMATES

	YEAR	BASIC PROGRAM	BASIC DATA BASE	CA	TIPS	FDAD	MAS	DABS	TOTAL	MM
NY	1980	85,648	118,982	44,646	17,501	20,442			204,630	13
	1982	85,648	120,557	46,769	17,825	20,631			250,851	16
	1984	85,648	127,420	48,353	18,113	20,817	63,440		297,780	19
	1986	85,648	128,973	49,785	18,377	20,971	66,020	5,000	364,870	23
	1988	85,648	127,749	51,119			67,740	5,000	373,132	23
LA	1980	80,920	58,553	22,067	11,501	12,299	49,680		139,473	9
	1982	80,920	58,996	22,709	11,621	12,369	51,830		161,983	10
	1984	82,690	63,902	23,092	11,765	12,489	53,980	5,000	193,101	12
	1986	82,690	62,405	23,558	11,897	12,566		5,000	246,857	16
	1988	82,690	65,109	23,989				5,000	252,441	16
CHI	1980	80,920	57,541	16,870	9,677	11,280	50,110		138,461	9
	1982	80,920	58,292	17,377	9,833	11,371	49,680	5,000	156,082	10
	1984	82,690	63,789	17,797	9,929	11,427	50,540	5,000	184,813	12
	1986	82,690	62,214	18,059	10,025	11,483		5,000	239,015	15
	1988	82,690	62,503	18,323				5,000	239,288	15
DET	1980	80,620	41,516	14,401	8,681	8,436	44,950		122,136	8
	1982	80,620	42,064	14,855	8,825	8,520	46,240	5,000	137,085	9
	1984	83,070	48,296	15,203	8,945	8,608	47,960	5,000	163,338	10
	1986	83,070	47,944	15,497	9,017	8,650		5,000	213,512	14
	1988	83,070	49,521	15,675				5,000	216,881	14
	1990	83,070	49,921						219,293	14

TABLE 1-4
ESTIMATE OF THE NUMBER OF REQUIRED ACTIVE PROCESSORS

LEVEL C TRAFFIC

	NY	LA	CHI	DET
1980	7*	3*	3*	3
1982	7	4	4	3
1984	8	4	4	3
1986	9	4	4	4
1988	8	4	4	4
1990	8	4	4	4

LEVEL B TRAFFIC

	NY	LA	CHI	DET
1980	7*	3*	3*	2
1982	7*	3*	3*	2
1984	7*	4	3	3
1986	8	4	4	3
1988	7	4	4	3
1990	7	4	4	3

*These numbers represent the planned initial configurations at New York, Chicago and Los Angeles. No attempt was made to determine if fewer processors could be used in 1980. For Detroit the assumed initial configuration included one processor. Therefore, the estimated processing requirements for Detroit in 1980 represent the minimum requirements for Level B and Level C traffic assumptions.

Memory and processing estimates for all model sites are derived by use of program sizes, processing times, lattice designs and data base designs of the New York ARTS IIIA system as standards. The New York system represents a large system configuration which has been optimized for processing efficiency. Thus using the New York system as a basis for determining processing requirements results in a high degree of confidence in estimates which show that the available processing capacity will not be exceeded for single and dual sensor sites. The memory requirements for single and dual sensor sites, however, may be slightly decreased if the standard ARTS IIIA programs are assumed instead of the New York program.

Table 1-5 shows the relative impacts of adding new functions to ARTS IIIs. The figures shown are for the New York system/Level C traffic.

TABLE 1-5 ESTIMATE NUMBER OF PROCESSORS REQUIRED FOR NEW FUNCTIONS

LEVEL C, NY TRACON

	<u>CA</u>	<u>FDAD</u>	<u>M&S</u>	<u>DABS</u>
1982	0.30			
1984	0.31	0.86		
1986	0.34	0.87	0.93	
1988	0.37	0.91	0.94	-0.37
1990	0.40	0.92	0.94	-0.37

2.0 INTRODUCTION

2.1 Background and Purpose

A continuing evolutionary approach is being taken to develop and implement improvements to the National Airspace System. With this approach, changes in the basic nature of the operational system are introduced in increments over successive system generations. The third generation level of capability, including the computer-based semiautomatic radar air traffic control system of basic NAS Stage A (en route) and basic ARTS (terminal), is now in operation.

ARTS IIIA is an enhanced version of the ARTS III terminal automation system, designed to provide automated radar target detection and tracking, expanded processing and storage capacity, automated failure recovery and reconfiguration, and minimum safe altitude warning. There are, currently, ARTS IIIA systems at two TRACONS, New York and Tampa. The Tampa system has been in operational use since June, 1979. The New York system is still in the installation phase. Current FAA plans calls for the upgrade of sixty-three ARTS III TRACONS to ARTS IIIA capability.

In order to meet the anticipated traffic control demands through the year 2005 at acceptable levels of safety and without introducing intolerable delays to the system users, a substantial upgrading of the third generation air traffic control system is in process. The engineering and development work leading to timely availability of this upgraded capability is the current challenge of the development programs.

Efforts to achieve the capabilities for upgrading the system are distributed among a number of Engineering and Development (E&D) programs, including the Terminal/Tower Control Program. These programs are oriented toward the common objectives of providing system capacity to meet the expected growth of air traffic, controlling costs, and maintaining or improving the present level of safety.

Many of the E&D programs will result in systems which will either be incorporated into ARTS IIIA or will interface to it.

The purpose of this study is to examine the capability of ARTS IIIA to support increasing processing demands imposed on it by anticipated traffic growth and by the implementation of expanded functional capabilities and interfaces in the period 1980 to 1990.

2.2 Scope

The scope of the study includes the detailed assessment of capacity requirements versus limitations at four sites and use of the results as indicators for capacity considerations at large metroplex systems, dual sensor sites, and single sensor sites. To this end, the study approach is to develop estimations of the processing and storage capabilities of ARTS IIIA, project the system configurations and traffic loads for each terminal area, characterize the processing and storage demands imposed by current and future terminal functions, and compare the capacity at each site to the anticipated capacity requirement.

3.0 ANALYSIS APPROACH

3.1 ENVIRONMENT ANALYSIS

Estimates of processing and storage requirements depend upon the configuration of the site and upon the volume of data to be processed during a busy period. Configuration parameters which impact the system load range from the number and types of sensors to the number of processors and the number and type of displays. The volume of data to be processed during a busy period is characterized by the peak instantaneous count of target reports, associated and unassociated tracks, and sensor noise within the system.

3.1.1 Site Configurations

Major external interfaces of the ARTS IIIA system are shown in Exhibit 3.1-1. A typical configuration of ARTS IIIA is shown in Exhibit 3.1-2.

3.1.1.1 Sensor Systems

This study assumes air traffic to be uniformly distributed around the airport from which they operate. As a result, estimates of traffic data to be processed by ARTS IIIA are sensitive to the detection range and scan rate of the radar at each site. Assumptions of long detection ranges result in high traffic counts, while assumptions of short ranges result in low traffic counts. Likewise, high scan rates result in high traffic counts.

Radar sensor systems used at various sites throughout the terminal ATC system include ASR-4, ASR-7, and ASR-8. However, it is understood that the ASR-4 and ASR-7 sensors will be upgraded to ASR-8 capability in future years. The schedule for sensor system upgrade has not been determined. As a result, the ASR-8 has been assumed to be implemented at all sites for this study. There are two advantages of this assumption. The analysis approach is simplified through the elimination of the type of radar as a parameter. In addition, the ASR-8 exhibits higher sensitivity characteristics than the ASR-4 and ASR-7. Thus, greater confidence can be placed on any study results which shown capacity limitations are not exceeded for a given site in any particular year.

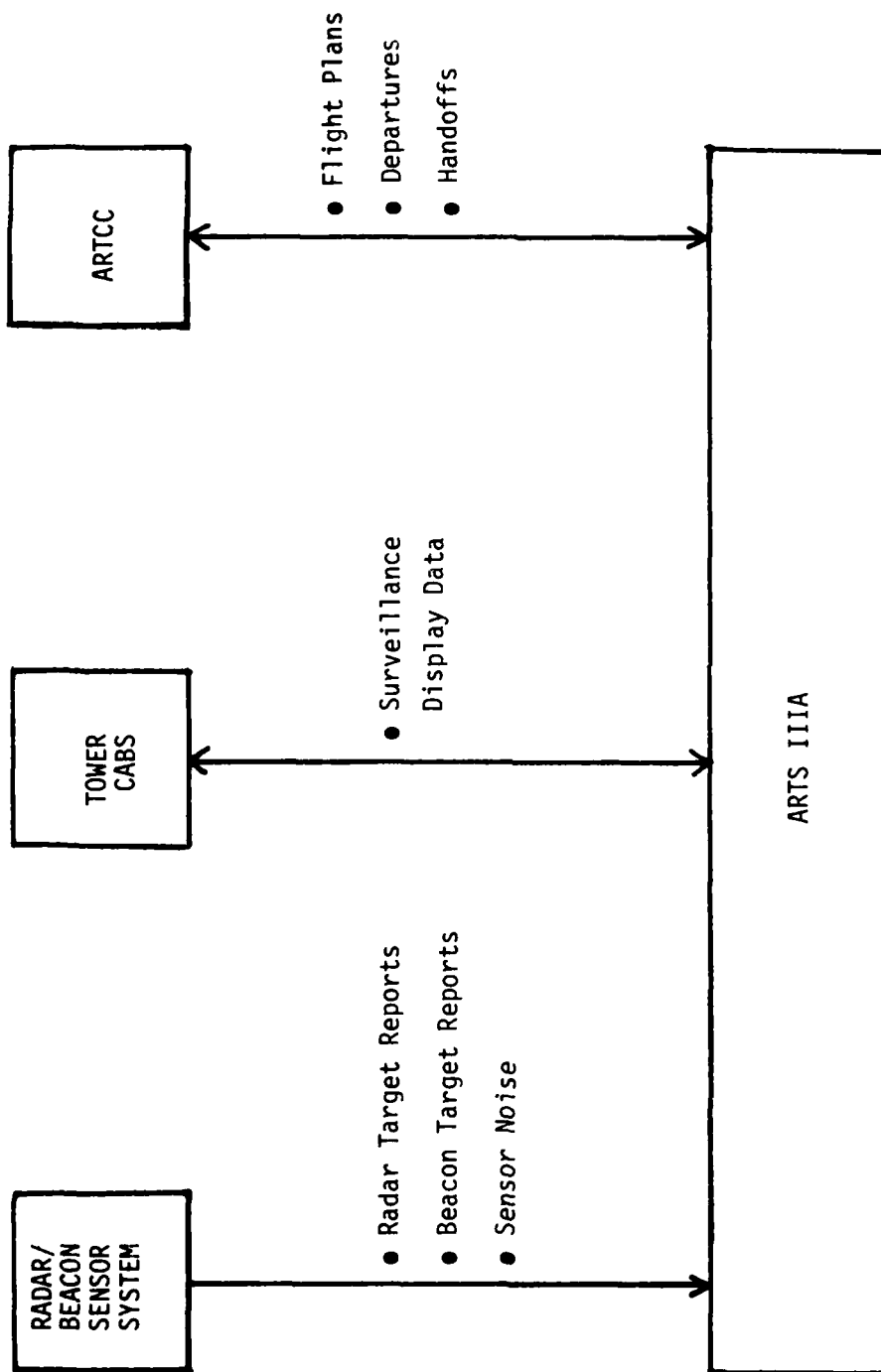


Exhibit 3.1-1 Major ARTS IIIA Interfaces

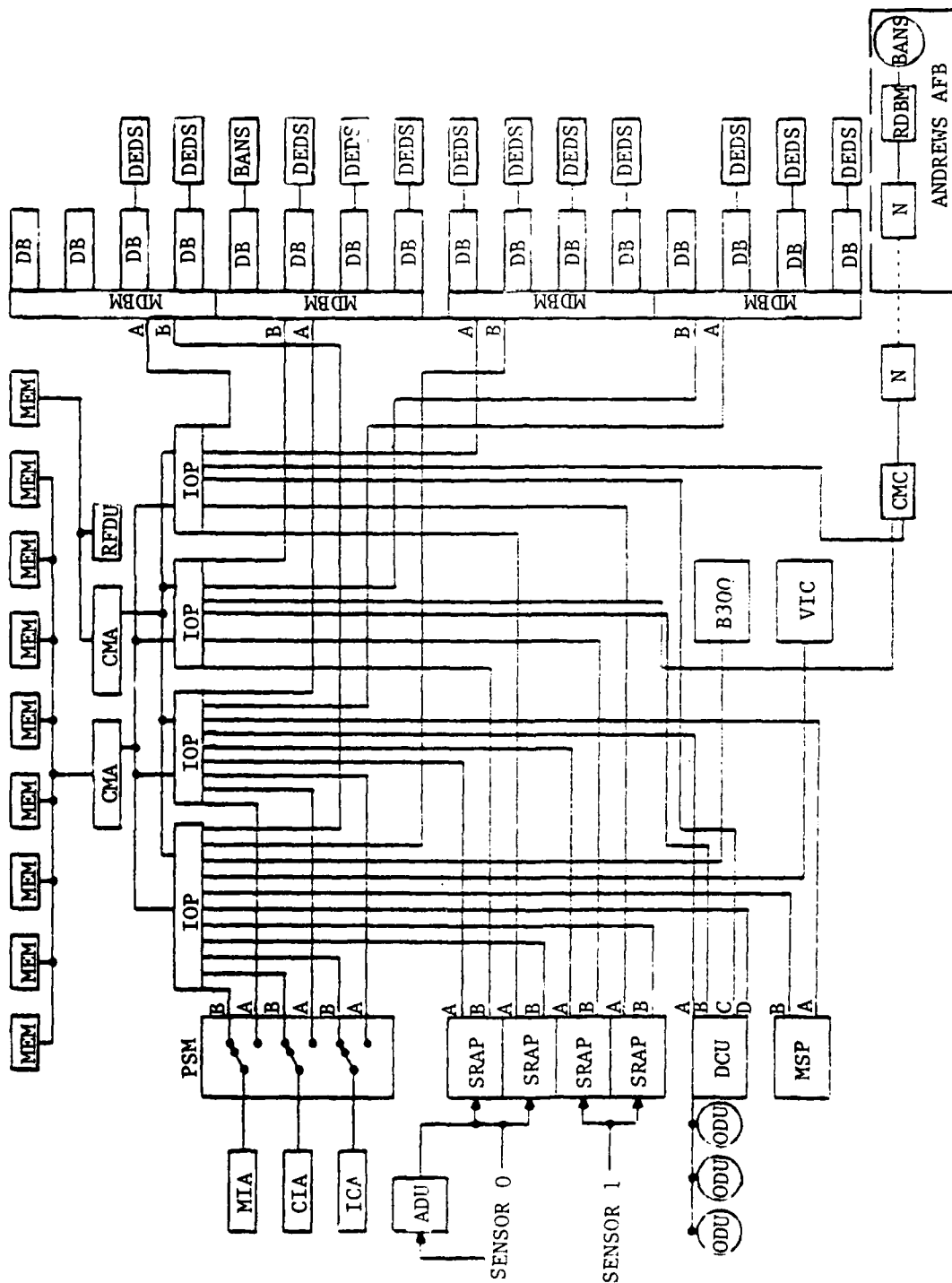


Exhibit 3.1-2 Typical ARTS IIIA System

The planned configuration for New York includes four radars:

	<u>Radar</u>	<u>Antenna</u>	<u>Beacon</u>
JFK	ASR-7	ASR-8	BI-4
EWR	ASR-7	ASR-8	BI-4
ISP	ASR-8		BI-5
HPN	ASR-8		BI-5

There are two radars at Chicago and Los Angeles. For Chicago they are

	<u>Radar</u>	<u>Antenna</u>	<u>Beacon</u>
• ORD	ASR-7	ASR-8	BI-4
• CHI-S	ASR-7	ASR-8	BI-4

The Los Angeles sensors are

	<u>Radar</u>	<u>Antenna</u>	<u>Beacon</u>
• LAX-7	ASR-7	ASR-8	BI-4
• LAX-4	ASR-4D	ASR-8	BI-4

There is a single radar at Detroit:

	<u>Radar</u>	<u>Beacon</u>
• DTW	ASR-8	BI-5

The number and location of each radar is assumed to remain fixed throughout the period of the study.

Initially, it is assumed that the Beacon sensor at each site is either the ATCBI-4 or ATCBI-5. These systems eventually will be replaced by DABS. For Chicago, Los Angeles and Detroit implementation of DABS is assumed to take place in 1986. Implementation in 1988 is assumed for New York.

It is generally expected that the maximum detection range of DABS will be approximately 100 miles, in contrast to 60 miles for the ATCBI-4 and ATCBI-5. The increased range of DABS has the potential of allowing a single DABS to replace two existing systems. However, it is not yet known how the peculiarities

of terrain will influence sheilding and the ability to achieve complete area coverage with a single sensor. If a single DABS sensor is used with dual radars, there may be registration problems which make it more difficult to correlate beacon replies to radar returns at some locations.

Since the addressing of the above problems is beyond the scope of this study, the simplifying assumption was made that each existing beacon sensor will be replaced by one DABS. This led to the further assumption that there would be no requirement to track or display beacon replies at ranges greater than 60 miles.

Therefore, a DABS cutoff range of 60 miles was assumed for all sites.

It is assumed that DABS will not only transmit beacon replies to ARTS IIIA, but that the radars will also interface through the DABS processor. All radar and beacon reports are assumed to be correlated to tracks before transmission. Since ARTS IIIA is a non-correlating user of DABS data, some software modules (TCRSS and TPSEC) required for correlation of target reports to tracks can be a eliminated when DABS is implemented.

3.1.1.2 Tower Cabs

The primary way in which a tower affects ARTS III capacity utilization is through the quantity and manner of interface of its displays. Initially the tower cab displays at all sites are assumed to be BANS displays. For each terminal system, the number of tower cab displays in 1980:

New York	7
Chicago	3
Los Angeles	2
Detroit	1

At New York, six tower cab displays interface to the TRACON processing system through RDBMs (Remote Display Buffer Memories) via a CMC (Communications Multiplexer Controller) and modems. LaGuardia Tower has its display connected through an MDBM (Multiplexed Display Buffer Memory). The Chicago, Los Angeles and Detroit BANS tower cab displays interface through MDBMs to the processors.

It is assumed that in 1984 the BANS (Brite Alpha Numeric System) displays will be replaced by TCDDs (Tower Cab Digital Displays). It is also assumed that, at that time, TCDDs will also be installed at all towers within 20 miles of the radars serving the TRACON. This method of estimating results in the following complements of remote displays in 1984.

New York	11
Chicago	5
Los Angeles	4
Detroit	5

No growth is assumed in the number of tower cab displays after 1984.

TCDD are assumed to require interface through an RDBM. Thus, it is assumed that RDBMs will be added to the Chicago, Los Angeles and Detroit systems in 1984. The software modules (RDOP, RTDOP and RKIP) required to interface to remote displays through RDBMs are currently included in the New York system and are assumed to remain throughout the time frame of this study. RDOP, RTDOP and RKIP are assumed not to be included in the Chicago, Los Angeles and Detroit systems until 1984.

3.1.1.3 Local Displays

The complements of displays for the four TRACONS for the years 1980 to 1990 are shown in Table 3.1-1. The list includes all displays for each TRACON, including displays at remote towers. It is assumed that DEDS (Data Entry and Display System) will be the display used at all sites before 1984, and that DEDS will be replaced by FDAD (Full Digital ARTS Display) in 1984.

3.1.1.4 ARTS IIIA Processing System

3.1.1.4.1 Sensor Receiver and Processor (SRAP)

The SRAP performs radar and beacon target detection, radar clutter mapping,

TABLE 3.1-1 ESTIMATED NUMBER OF TRACON DISPLAYS (LOCAL AND REMOTE)

		<u>1980</u>	<u>1982</u>	<u>1984</u>	<u>1986</u>	<u>1988</u>	<u>1990</u>
New York:	JFK	19	19	21	21	21	21
	EWB	15	15	16	16	17	17
	HPN	7	7	8	8	8	8
	ISP	5	5	5	5	6	6
Chicago:	ORD	14	14	15	15	15	15
	CHI-S	6	6	7	7	7	7
Los Angeles:	LAX-4	8	8	9	9	11	11
	LAX-7	6	6	7	7	9	9
Detroit:	DTW	11	11	15	15	17	17

and radar/beacon target correlation. It transmits data to the TRACON consisting of

- Radar only target reports
- Beacon only target reports
- Radar reinforced beacon target reports
- Sector marks
- Alarm messages

Two SRAPs are connected to each sensor system for redundancy.

Target reporting functions will be performed by the DABS processors when DABS is implemented. At that time, SRAPs will no longer be needed.

3.1.1.4.2 Input - Output Processor B (IOPB)

IOPs perform the basis executive control and data processing functions of the ARTS IIIA system. They are provided with addressing capability for up to 16 memory modules (16K words per memory module). Each IOP is connected through a CMA (Central Memory Access) to all memory modules.

In a fail safe configuration, ARTS IIIA systems will be configured with one to seven active on-line IOPs and one spare. The spare provides a fail safe capability by remaining on standby, fully connected into the system with power on. In this state, it can automatically be brought on line to replace a failed processor. Except for New York, ARTS IIIA facilities are not scheduled to be provided with spare IOPs.

In the analysis, it is assumed that the number of on-line processors may be expanded in any year up to a maximum of seven as required at each site to process the projected load.

3.1.1.4.3 Memory Module (MEM)

Each memory module provides storage for 16,384 thirty bit words of data and programs. A maximum of 15 modules may be included in a system configuration.

3.1.1.4.4 Central Memory Access (CMA)

The CMA is the interface module for memory modules and the RFDU (Reconfiguration and Fault Detection Unit). Memory modules and the RFDU are connected to the IOPs through CMAs. Each IOP connected to a CMA can communicate with all memories connected to the CMA. Each CMA provides interfaces for up to eight memories or up to seven memories and one RFDU. A system containing eight or more memories requires two CMAs. The maximum system configuration consists of two CMAs interfacing seven IOPs to 15 memories and one RFDU.

3.1.1.4.5 Reconfiguration and Fault Detection Unit (RFDU)

The RFDU provides for automatic or manual reconfiguration of up to eight IOPs and 15 memory modules.

3.1.1.4.6 Multiplexed Display Buffer Memory (MDBM)

An MDBM provides display refresh control, keyboard entry control and display data storage for one to four DEDS or BANS displays. Starting in 1984, it is assumed that an MDBM (or similar multiplexing device) will provide the same type of interface for FDAD. Whether the FDAD's display buffer memory is provided in the MDBM or is internal to the display has no impact on this study.

3.1.1.4.7 Remote Display Buffer Memory (RDBM)

An RDBM provides display refresh control, keyboard entry control, and data storage for a remote display. Data transfers between RDBMs and IOPs take place through modems and a Communications Multiplexer Controller (CMC).

3.1.2 IAC Estimates.

3.1.2.1 Introduction.

The expression "IAC" (Instantaneous Airborne Count), as used in this report, refers to the number of aircraft that are instantaneously within the coverage area of a given surveillance site. Since many of the system's processing functions are related to aircraft in the airspace under surveillance, the number of such aircraft is an essential part in making any determination of the processing demands. Further, since the specific tasks executed are contingent on available data pertaining to the aircraft being processed, it is additionally necessary that the IAC be broken down into subsets relevant to the processing required. This breakdown has been termed "IAC System Load Factors" and is presented in Table 3.1-2.

At the time of this effort, there were no previously developed IAC estimates available that specifically addressed the needs of the study; viz., what is the expected IAC and what is its expected composition during periods of high activity for each of the next ten years at each of the surveillance sites associated with the ARTS IIIA locations included in the study. Consequently, it was necessary to undertake the development of these estimates as part of the overall effort.

3.1.2.2 General Approach.

In selecting a general approach, several alternatives were considered. One was to arbitrarily establish incremental levels for the IAC system load factors. This approach is useful in determining system sensitivity to various load factors and was used as part of the efforts to develop task time equations. It does not, however, address the question of what load might be expected at a given site at a given time. Another approach was to make projections from historical data based on forecast increases or decreases in annual activity. Unfortunately, historical data available relevant to IACs are sparse and incomplete and it is not known whether the data were acquired during periods of low, medium or high aerial activity.

TABLE 3.1-2
IAC SYSTEM LOAD FACTORS
(Each Surveillance Site)

TOTAL TARGET REPORTS

Radar Only

Beacon Only

Discrete

Non-Discrete

Mode C

Radar Reinforced Beacon

Discrete

Non-Discrete

Mode C

ASSOCIATED TRACKS

Radar Only

Beacon Only

Discrete

Non-Discrete

Mode C

Radar Reinforced Beacon

Discrete

Non-Discrete

Mode C

UNASSOCIATED TRACKS

Radar Only

Beacon Only

Discrete

Non-Discrete

Mode C

Radar Reinforced Beacon

Discrete

Non-Discrete

Mode C

Cross-Linked with Associated
Track in another system

UNUSED TARGET REPORTS

Radar

Beacon

The approach that was adopted is aimed at deriving estimates of the IAC from terminal area forecasts of annual activity and deriving estimates of the IAC break down (i.e., IAC system load factors) through the application of reasoned assumptions. In general, the approach involves the estimation of busy hour operations from forecasts of annual activity and historical data relative to busy/average hour relationships, the estimation of instantaneous counts from busy hour estimates and a break down of these estimates into the various categories relevant to processing requirements. The approach is keyed on several basic assumptions. These are:

- The IAC is related to the number of operations at airports in the vicinity of the surveillance site of interest. In this regard, "vicinity" is considered to be within 60 nautical miles (the normal range limit of current terminal surveillance systems) and "airports" are limited to those public use or military airports having a paved runway 1,500 feet or greater in length and, as a practical matter, for which annual activity forecast and/or historical data are available.
- The higher IACs occur during good weather conditions with the peaks occurring when conditions are such as to strongly stimulate the urge to fly on the part of many private and student pilots -- probably on a weekend or holiday in the spring of the year.
- The higher activity in terms of airborne flights simultaneously receiving terminal radar services (analogous to associated tracks in the system) occurs during poor weather conditions.
- The instantaneous count of associated tracks is related to the number of instrument operations handled by the TRACON.

3.1.2.3 Annual Activity Base Numbers.

The sources of the base (annual activity) numbers used in the estimation process were:

- For Public Use Airports: FY1977 activity and FY1979-1990 forecast values from FAA's terminal area forecast data base.
- For Military Airports: The Military Air Traffic Activity Report for CY1976, published by the FAA. Forecast activity data for these airports were not available, however, general forecasts of military air traffic activity indicate it will remain relatively unchanged during the 1979-1990 period. Therefore, as was done by the FAA in their forecasts of military operations at public use airports, the values for the military airports throughout the period were assumed to remain the same.

The base numbers available for public use airports are broken down by operations category (Itinerant, Local and Instrument). Itinerant and Local are further broken down by aviation category (Air Carrier, Air Taxi and Commuter, General Aviation and Military). The reporting categories for the military services differ among the services and with those of the FAA. Total operations are reported. However, the Air Force and Navy do not break out Itinerant and Local operations and none of the services break down civil traffic into Air Carrier, Air Taxi and Commuter, and General Aviation categories. Consequently, for the military airport base numbers, where Itinerant and Local operations were not broken out, each were assumed to equal 50% of the Total operations value. Additionally, civil aircraft were assumed to all be in the General Aviation category.

Potential overflights (i.e., flights that originate and terminate at airports outside the 60 mile radius) were not considered in the estimation process for several reasons. First, a means of estimating the number of such flights simultaneously in the area was not apparent. Second, it is reasonable to believe that this number would be quite small as compared to the number of flights operating to/from airports in the vicinity. Finally, there is some compensation for this omission that results from unavoidable double-counting of some of the itinerant flights. More specifically, since the "other" airport to/from which an itinerant flight is proceeding is unknown, it is assumed that the other airport lies outside the area (i.e., it is not one of the airports whose itinerant operations forecast is also

included in the IAC estimation process). Thus, for that portion of the itinerant traffic that originates at one airport in the area and terminates at another airport in the area, double-counting will result. It is reasonable to believe that this number will also be relatively small.

3.1.2.4 Methodology.

Different processes and assumptions are applied in deriving the estimated instantaneous airborne counts and the estimated instantaneous associated track counts. Following these processes, the results are merged to determine the final set of values for the IAC system load factors, i.e., number of Target Reports, Associated Tracks, Unassociated Tracks, etc..

IAC estimates were made for two different sets of assumptions related to general weather conditions (Good and Poor). Additionally, IAC estimates were made for a period of average activity and for two different assumptions concerning busy/average hour ratios during a period of high activity, the latter providing a range to the high activity estimates used in assessing the impact on processing.

The instantaneous associated track counts were estimated on the basis of poor weather conditions. During good weather conditions, the instantaneous associated track counts were assumed to approximate 75% of the poor weather values.

The processes and assumptions applied in estimating the instantaneous airborne counts, the instantaneous associated track counts, and in the merging of these estimates to derive the IAC system load factors are described in Appendix A.

3.1.2.5 Resulting Estimates.

The IAC system load factors estimated for each of the surveillance sites included in the analysis effort are contained in Appendices G - J. Estimates are provided for FY77 (based on reported annual activity data) and for FY80, FY82, FY84, FY86, FY88 and FY90 (based on forecast annual activity data).

In the breakdown of categories, the group headed "BASE" represent the estimated IAC base values and the group headed "ADJUSTED" represent the estimated target report values. The remaining nomenclatures conform to those contained in Table 3.1-2.

The columns headed A, B and C reflect the use of different busy/average hour ratio assumptions in deriving IAC base value estimates as discussed in paragraph 1.2, Appendix A. The A column reflects estimates of instantaneous counts during an average hour whereas the B and C columns reflect a low and high range of estimates of the instantaneous counts during a busy hour.

It will be noted that the entries for associated tracks and cross-linked tracks appear only under column B. This is because differing busy/average hour ratios were not used in estimating associated tracks (see paragraph 3.2, Appendix A), thus, the same values appearing under column B also apply to the A and C columns.

3.1.3 IAC Estimate Validation.

The IAC estimation methodology has, of necessity, been based on numerous assumptions. While conscientious efforts were made to apply sound judgments in making these assumptions, it would, of course be highly desirable to have a means of verifying the accuracy of the estimates produced by the process. However, a precise and practical method of doing this is not obvious. For one thing, the process is aimed at converting forecasts of annual activity into estimates of peak (or near peak) instantaneous counts during periods of high activity where high activity is in terms of all aircraft in the airspace of interest, not just those receiving air traffic control service. It is during such periods that the system will be taxed most severely. However, it is difficult to predict just when such conditions will occur, thus, it is extremely difficult to mount and time a special data collection effort that will assure actual IAC data is captured under these conditions. As was noted earlier in this report, field measurement data relevant to IACs are sparse and incomplete, and it is not known whether the counts are representative of low, medium or high levels that may be encountered during the course of the year.

Notwithstanding the above, some comparisons of the results produced by the methodology have been made with field data samples provided by the FAA. In making these comparisons, the objective was to determine if the estimated totals appeared reasonable bearing in mind that whether the field data represented low, medium or high values for the year was unknown. The focus was on totals (rather than composition of the totals) because these values have the greatest impact on system loading.

Data were provided by the FAA for each of the nine surveillance sites. The data for the New York surveillance systems were taken at the New York TRACON in conjunction with system integration and shakedown efforts and represent "snapshots" of the instantaneous number of active tracks in each surveillance system at different points in time. The data for the Chicago, Los Angeles and Detroit surveillance sites were derived from beacon target

report data recorded at these sites over hourly periods for several different hours. These data were reduced by ARD-143 to reflect the average and peak number of beacon target reports per scan during each of the hours recorded.

The date, day of the week, time of day (local), peak count and, weather conditions of the field data samples are as shown in Table 3.1-3.

TABLE 3.1-3

PEAK TRAFFIC COUNT MEASUREMENTS FOR
NEW YORK, CHICAGO, LOS ANGELES, AND CHICAGO
(Provided by FAA)

<u>Site</u>	<u>Date</u>	<u>Day of Week</u>	<u>Time (Local)</u>	<u>Weather Conditions</u>	<u>Peak Count</u>	
New York	6-7-79	Thur	0845-	IFR	407	} Peak Total Track Counts (4 sensors)
	6-8-79	Fri	0903-	Marginal VFR	336	
	6-8-79	Fri	1608-	Marginal VFR	497	
	6-10-79	Sun	1440	Good VFR	527	
	6-28-79	Thur	1619	Marginal VFR	677	
	6-29-79	Fri	1614	Marginal VFR	710	
Chicago	8-17-79	Fri	1445-1545	VFR	296	} Peak Total Beacon Reports (2 sensors)
	8-17-79	Fri	1545-1645	VFR	253	
	8-17-79	Fri	1659-1759	VFR	288	
	8-29-79	Wed	1430-1530	VFR	243	
	8-29-79	Wed	1530-1630	VFR	264	
	8-29-79	Wed	1630-1730	VFR	254	
Los Angeles	8-11-79	Sat	1030-1130	VFR	350	} Peak Total Beacon Reports (2 sensors)
	8-11-79	Sat	1130-1230	VFR	327	
	8-11-79	Sat	1230-1330	VFR	308	
	8-11-79	Sat	1330-1430	VFR	306	
	9-13-79	Thur	0500-0930	VFR	277	
	9-13-79	Thur	1000-1400	VFR	298	
	9-13-79	Thur	1429-1559	VFR	293	
	9-13-79	Thur	1600-1830	VFR	327	
	9-15-79	Sat	0500-0830	VFR	326	
	9-15-79	Sat	0900-1400	VFR	369	
	9-15-79	Sat	1439-1539	VFR	315	
	9-15-79	Sat	1600-1930	VFR	245	
	9-20-79	Thur	0500-1000	VFR	277	
	9-20-79	Thur	1030-1430	VFR	306	
	9-20-79	Thur	1459-1559	VFR	354	
	9-20-79	Thur	1600-1830	VFR	332	
	9-22-79	Sat	0500-1000	Marginal VFR	301	
	9-22-79	Sat	1030-1430	Marginal VFR	346	
	9-22-79	Sat	1459-1559	VFR	316	
	9-22-79	Sat	1605-2005	VFR	276	
	9-27-79	Thur	0500-1000	VFR	306	
	9-27-79	Thur	1020-1430	VFR	351	
	9-27-79	Thur	1450-1550	VFR	356	
	9-29-79	Sat	0500-1000	VFR	365	
	9-29-79	Sat	1030-1500	VFR	298	
	9-29-79	Sat	1610-2140	VFR	238	
Detroit	10-4-79	Thur	0859-1029	IFR	76	}
	10-4-79	Thur	1040-1140	IFR	59	
	10-4-79	Thur	1205-1435	IFR	70	
	10-4-79	Thur	1520-1750	IFR	97	
	10-6-79	Sat	0920-1150	IFR	66	
	10-6-79	Sat	1210-1440	IFR	51	
	10-6-79	Sat	1510-1640	IFR	55	
	10-6-79	Sat	1650-1750	IFR	49	

TABLE 3.1-3 (Cont'd.)

<u>Site</u>	<u>Date</u>	<u>Day of Week</u>	<u>Time (Local)</u>	<u>Weather Conditions</u>	<u>Peak Count</u>	
Detroit (continued)	1-10-80	Thur	1600-1700	VFR	92	} Peak Total Beacon Reports (1 sensor)
	1-12-80	Sat	0900-1100	VFR	72	
	1-12-80	Sat	1200-1400	VFR	110	
	1-12-80	Sat	1430-1630	VFR	120	
	1-13-80	Sun	0900-1130	VFR	102	
	1-13-80	Sun	1200-1330	VFR	112	
	1-13-80	Sun	1400-1530	VFR	129	
	1-13-80	Sun	1600-1730	VFR	122	
	1-14-80	Mon	1130-1500	VFR	75	

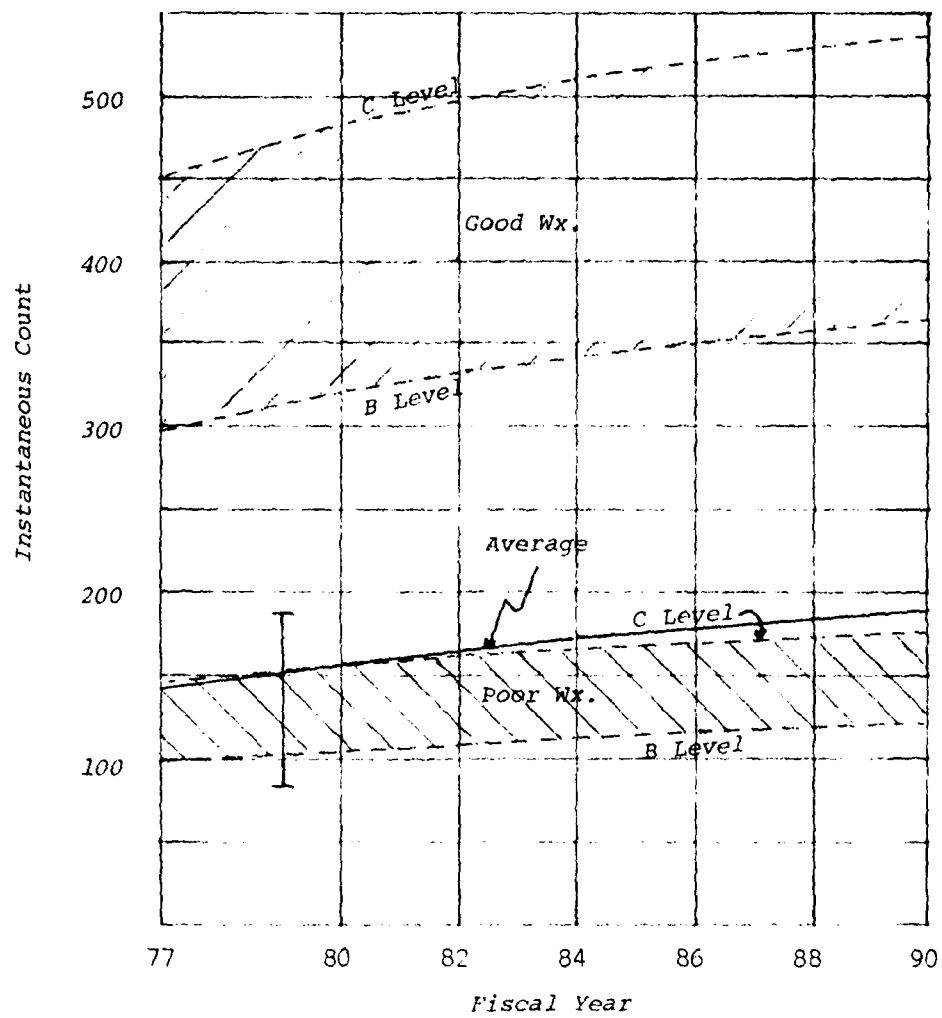
Comparisons of the IAC estimates with the field data samples for each of the surveillance sites are reflected in Exhibits 3.1-3 through 3.1-11. These exhibits portray the following:

- The estimated IAC during an average hour. This corresponds to to the A (average) hour assumption concerning busy/average hour ratios. (See paragraph 1.2, Appendix A)
- The range of the IAC estimates for a busy hour (i.e., the B and C busy/average hour ratio assumptions) under both good and poor weather conditions.
- The range of the peak counts in the field data samples.

It should be noted that since the New York field data samples were with respect to tracks, the IAC estimates for the New York surveillance sites are also with respect to tracks. Since the data for the other sites were with respect to beacon target reports, the IAC estimates portrayed for these sites are also with respect to beacon target reports.

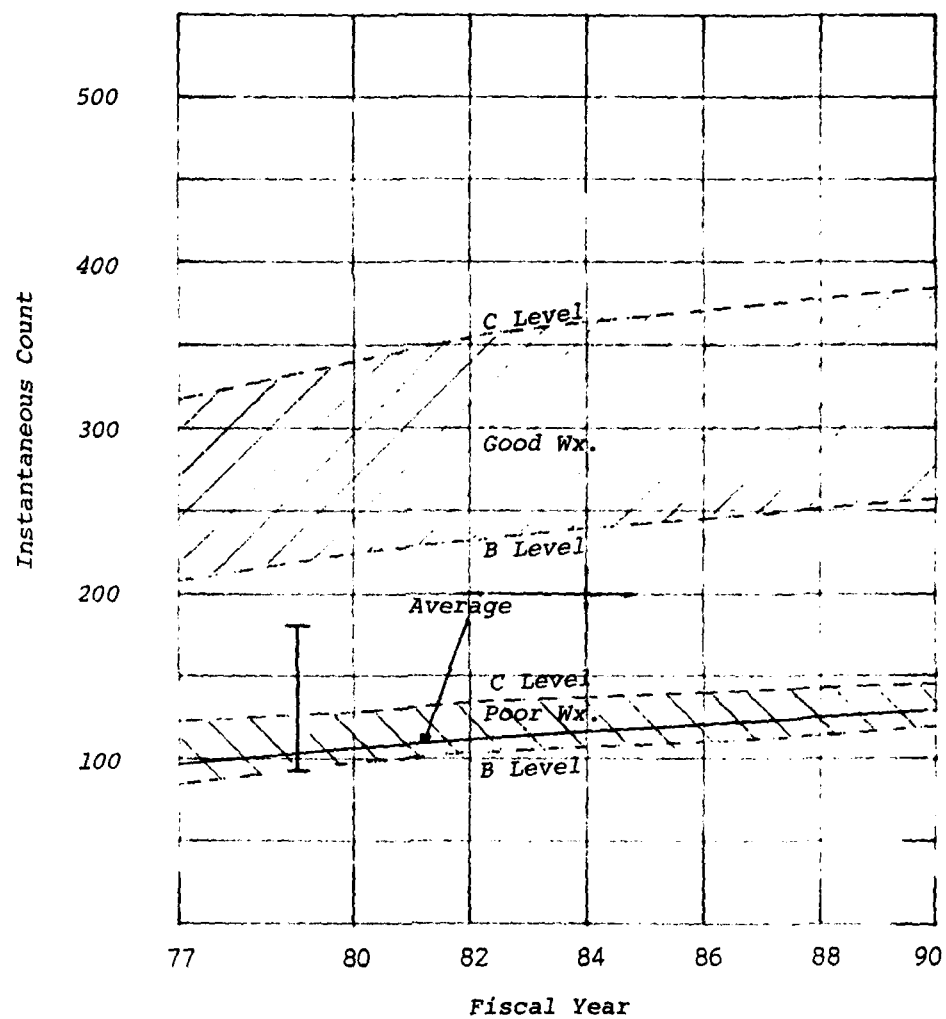
A review of the exhibits leads to the following observations:

- For the New York systems (JFK, EWR, HPN and ISP), the range of the field data samples brackets the estimated average IAC, with the higher counts falling somewhere between the upper poor weather estimate and the lower good weather estimate. As a matter of interest, the field data provided for New York did include some annotations regarding the general weather conditions at the time the data was taken. One sample was during IFR, one during VFR and the remaining four during marginal conditions. The high and low samples both occurred when the weather conditions were marginal.



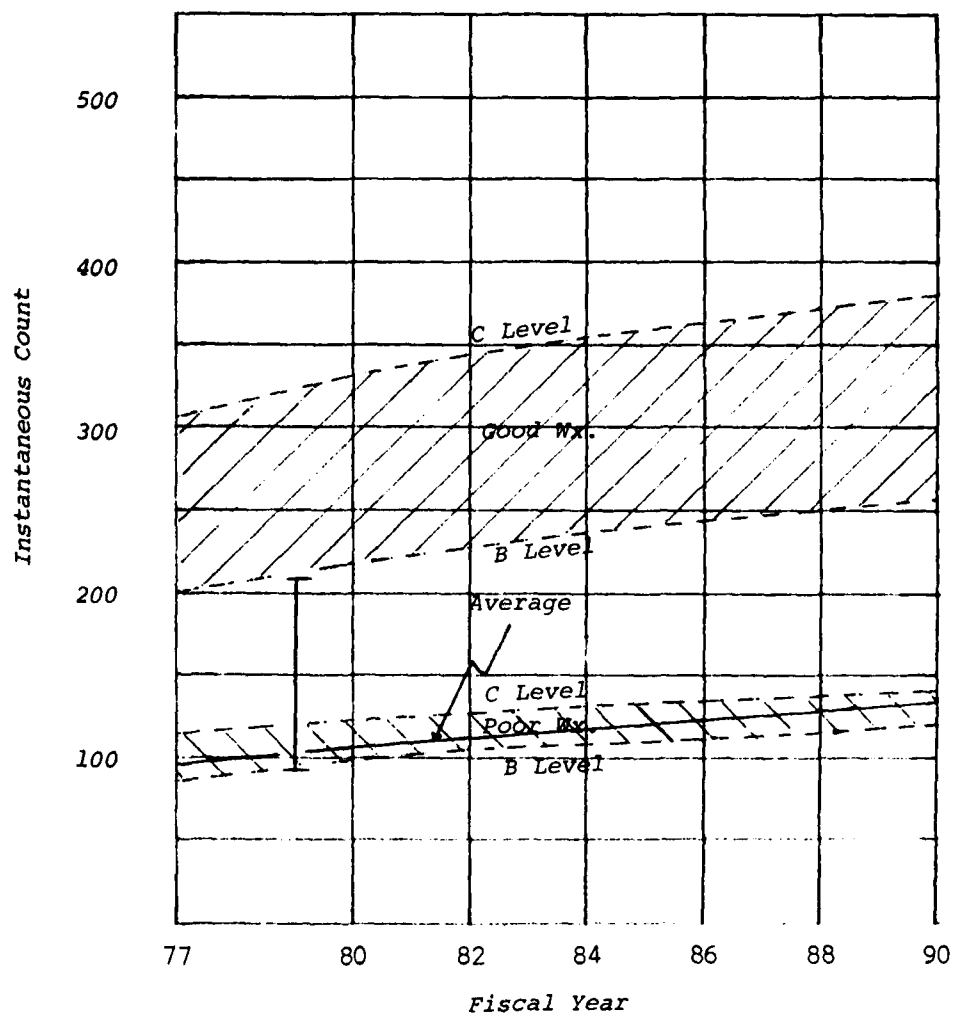
I
Range of 6 field samples

EXHIBIT 3.1-3
Estimated Peak Instantaneous Total Tracks - JFK



Range of 6 field samples

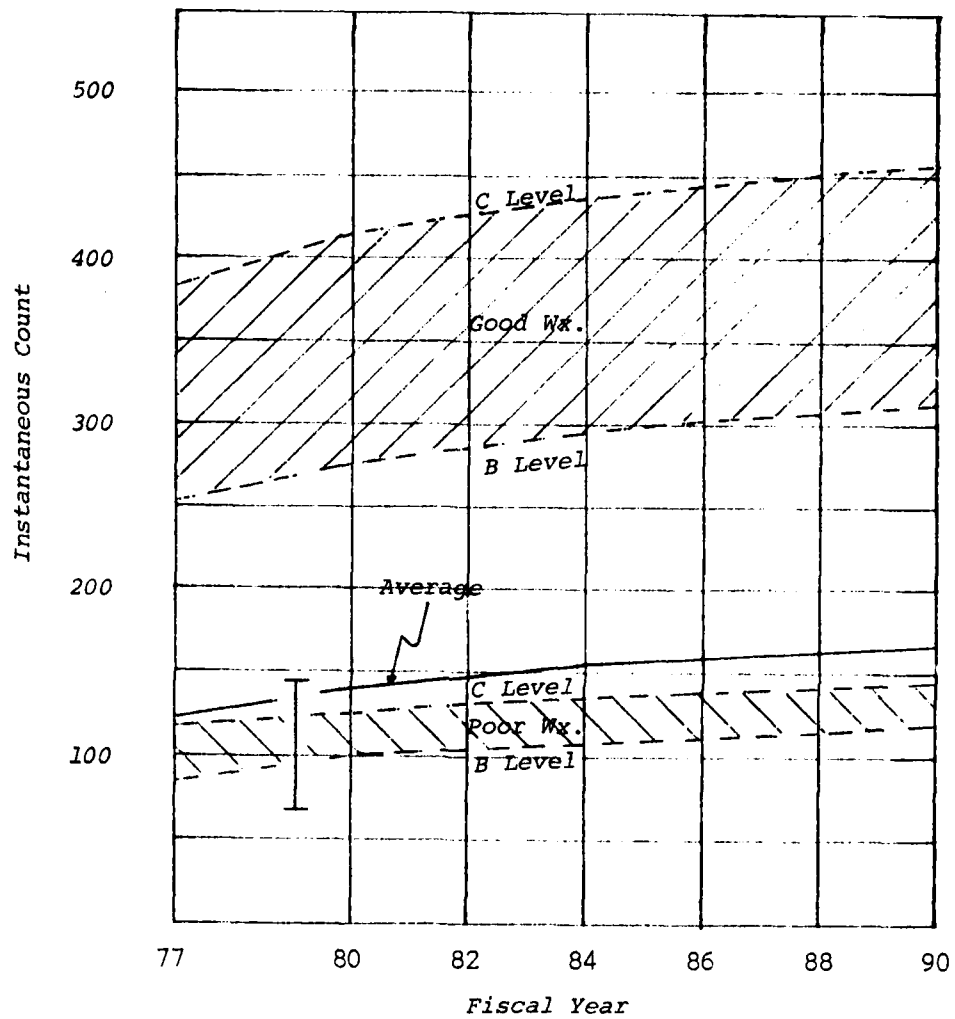
EXHIBIT 3.1-4
Estimated Peak Instantaneous Total Tracks - EWR



Range of 6 field samples

EXHIBIT 3.1-5

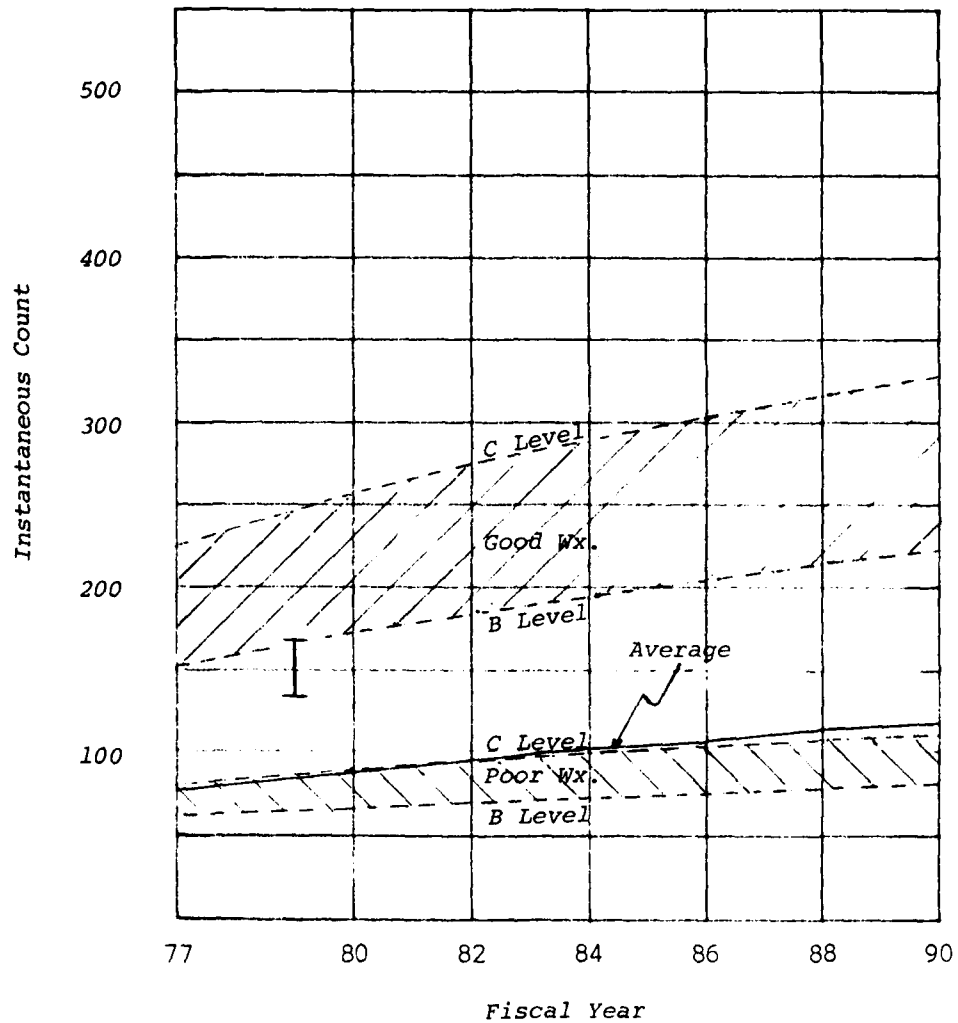
Estimated Peak Instantaneous Total Tracks - HPN



Range of 6 field samples

EXHIBIT 3.1-6

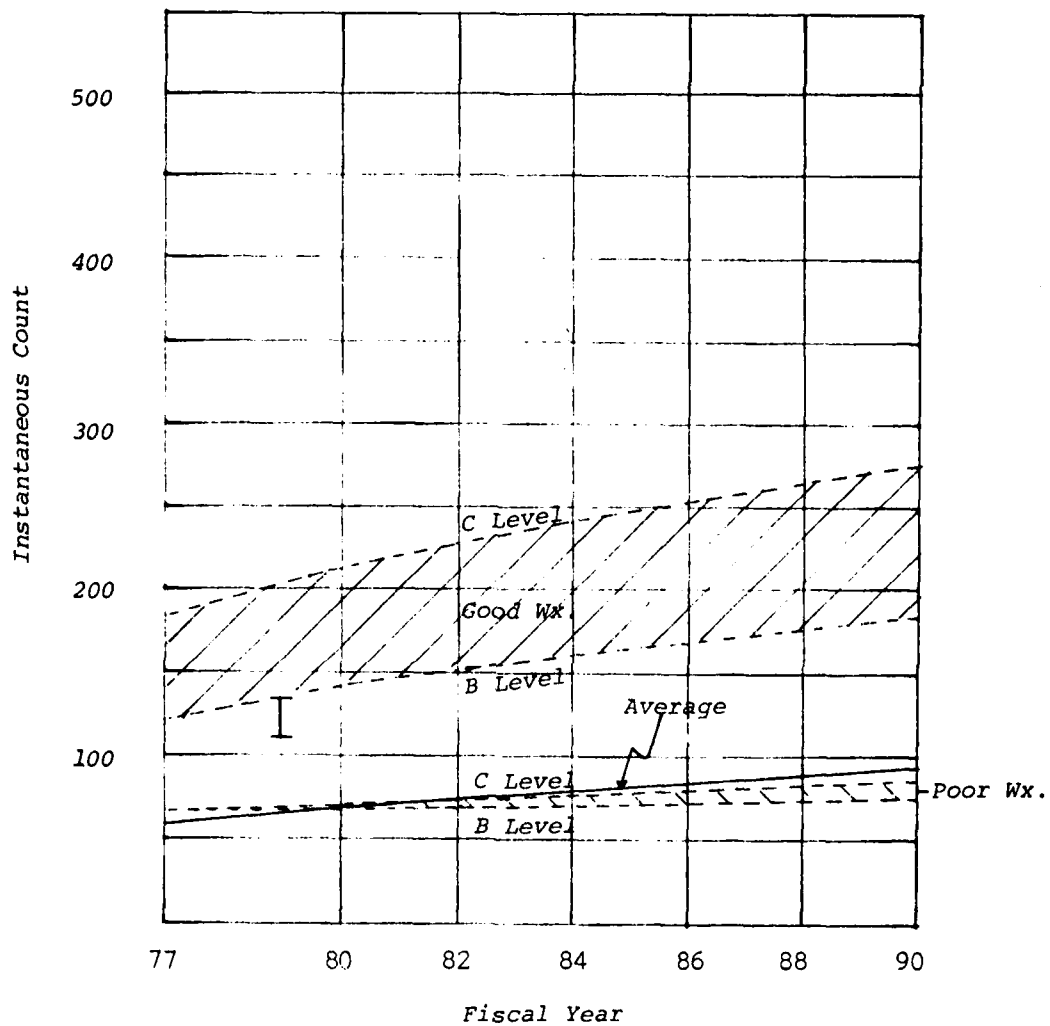
Estimated Peak Instantaneous Total Tracks - ISP



I Range of 6 field samples

EXHIBIT 3.1-7

Estimated Peak Instantaneous Beacon Target Reports - ORD




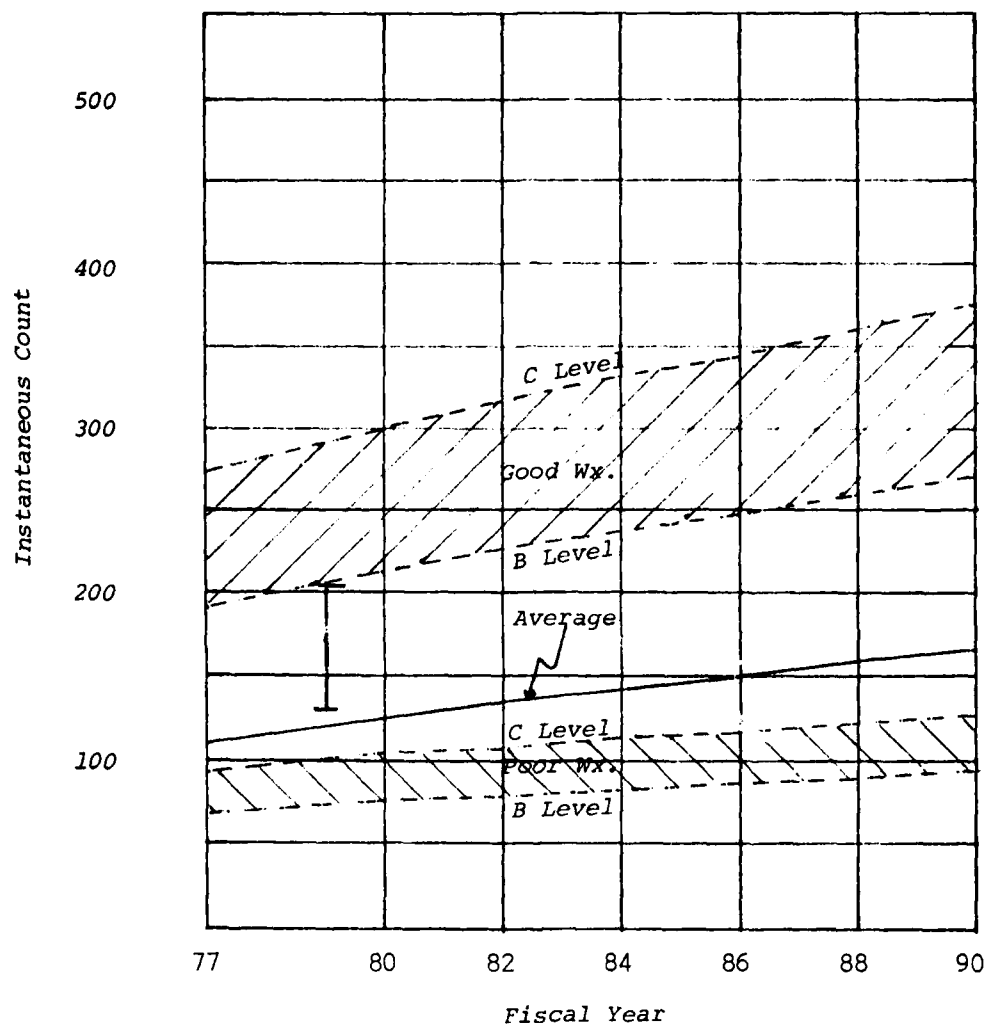

 Range of 6 field samples

EXHIBIT 3.1-8

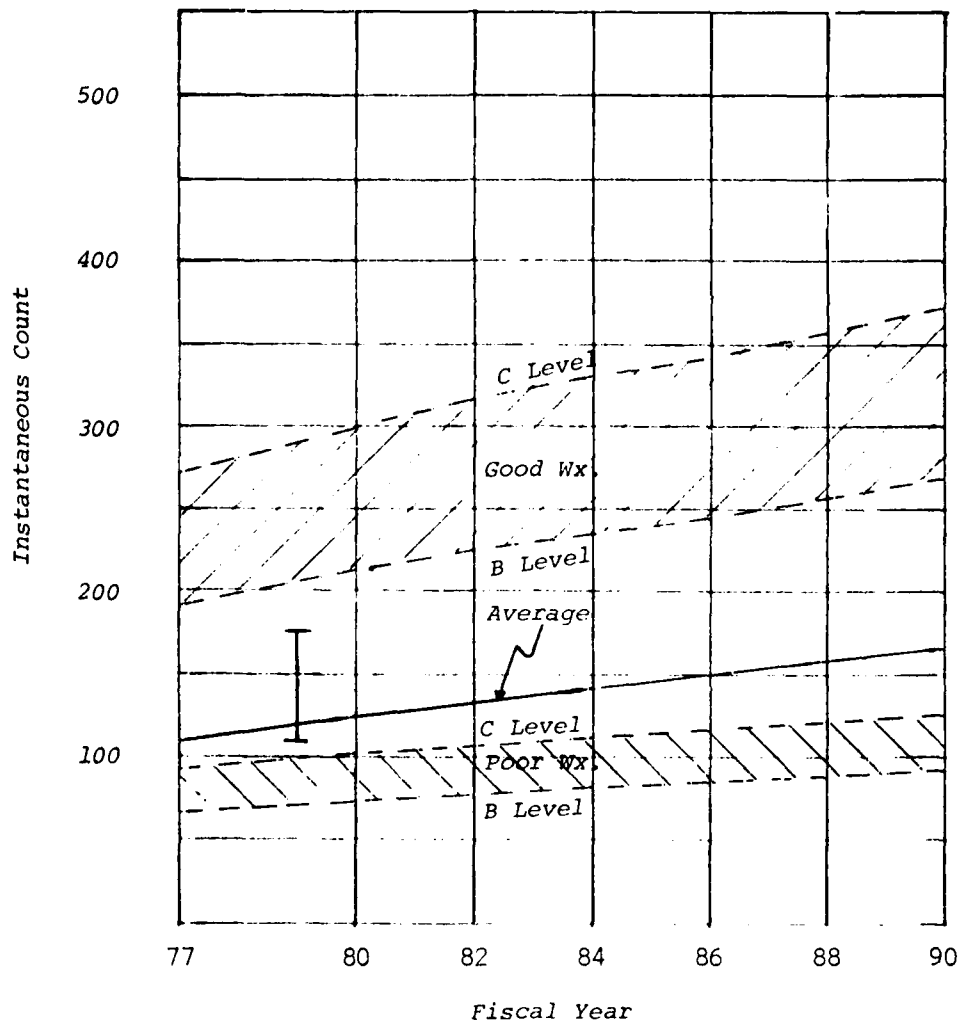
Estimated Peak Instantaneous Beacon Target Reports - CHI-S



I
Range of 25 field samples

EXHIBIT 3.1-9

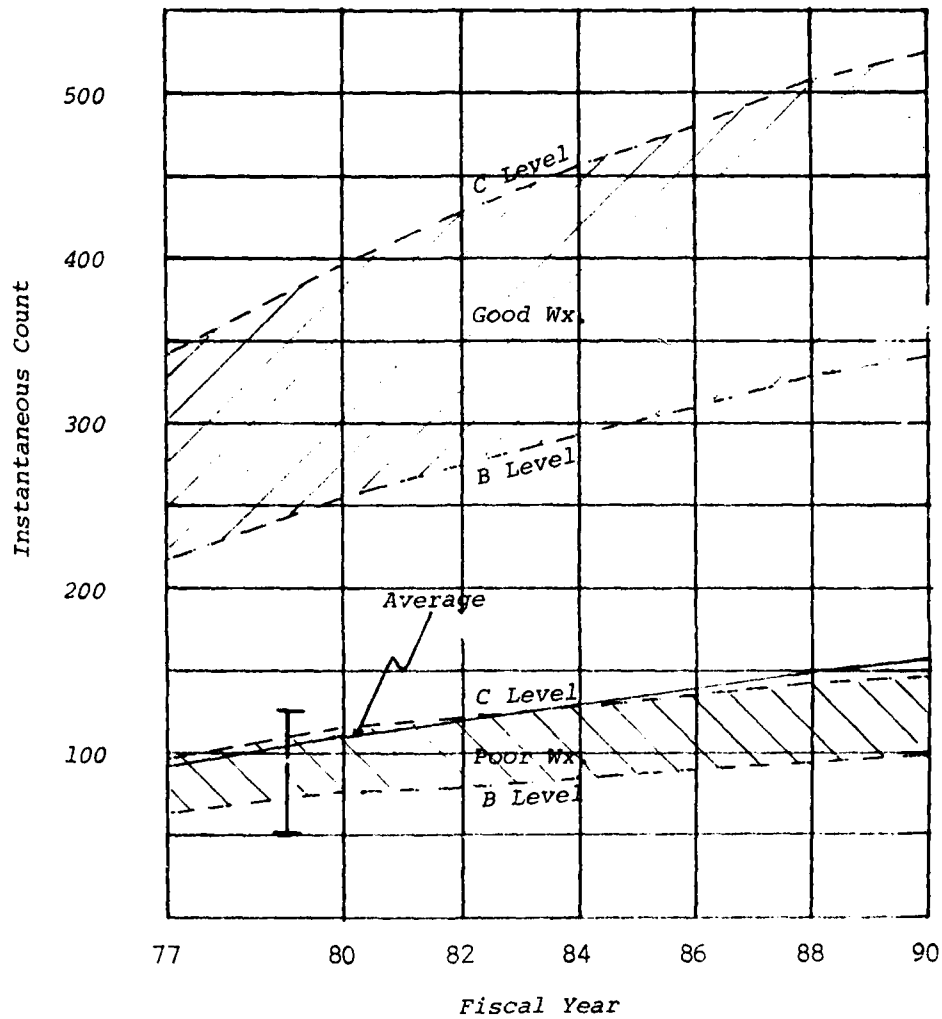
Estimated Peak Instantaneous Beacon Target Reports - LAX4



Range of 25 field samples

EXHIBIT 3.1-10

Estimated Peak Instantaneous Beacon Target Reports - LAX7



I
Range of 17 field samples

EXHIBIT 3.1-11

Estimated Peak Instantaneous Beacon Target Reports - DTW

- For Chicago (ORD and CHI-S) the field data samples were all well above the estimated average IAC. The range of counts extended up to the lower of the good weather estimates.
- For Los Angeles (LAX4 and LAX7) the field counts were generally well above the estimated average IAC. The highest counts fall somewhat below the lower traffic level of the good weather estimates.
- For Detroit (DTW) the field data samples fluctuated about the estimated average IAC. About half of the 17 field samples were recorded during IFR weather conditions. For these cases, the measured counts generally agree with the poor weather estimates. The good weather samples, however, extend only somewhat above the estimated average IAC. This could be the result of underestimating the average radar shielding angle at DTW. (A 0° shielding angle was estimated from an examination of DTW panoramics taken in 1975). The application of average shielding angles in the IAC estimation methodology has the effect of reducing the instantaneous count estimates.

Based on the above observations and considering the uncertainties as to whether the field data samples represent low, medium or high instantaneous counts for the year, there appears to be no reason to conclude that the estimated IACs are unreasonable.

3.2 PROCESSING REQUIREMENTS ANALYSIS

3.2.1 Introduction

The ARTS IIIA software functions have been described in Reference 1 as consisting of eight major areas:

- Multiprocessor Executive (MPE)
- SRAP Input Processing
- Tracking
- Display Output Processing
- Keyboard Input Processing
- Interfacility Flight Plan Processing
- MSAW
- Continuous Data Recording

The MPE provides overall control of the operational program by scheduling the processing of functional tasks. There are two types of tasks: planned tasks and popup tasks. Planned tasks are scheduled in accordance with rules of precedence of a list structure called a lattice. Popup tasks are scheduled independently of the lattice precedences for planned tasks. Popup tasks may be executed at random or periodic intervals. Random popup tasks typically are interrupt driven and are used for processing of functions with indeterminate schedules, such as output to peripherals. Periodic popups typically provide processing for external functions, such as keyboard input or SRAP input, which can be controlled by polling.

The SRAP Input processing accepts declared targets and passes them to tracking.

The tracking function performs a scan-to-scan correlation of the declared targets to provide aircraft position, ground speed and altitude for display output

processing. The tracking function operates separately on the data from each sensor system. It has an automatic track start and acquisition feature for beacon and radar targets. It maintains track files on all declared tracks.

The display output function gathers data from the tracking function, keyboard input function, MSAW function, and the interfacility processing and prepares it for output to the displays through MDBMs.

The keyboard input processing function accepts data from the keyboards and performs the desired function.

Interfacility flight plan processing communicates with the ARTCC computer. This function accepts flight plan information and passes this data to the tracking and display output functions.

MSAW includes altitude tracking and general terrain and approach path warning logic.

The objective of the analysis of ARTS IIIA processing requirements is to quantify ARTS IIIA processor utilization as a function of system configuration, functional capability, lattice structure, and load factors imposed by the external environment.

The processing analysis has been separated for convenience into three areas:

- Analysis of the multiprocessor executive scheduler algorithms.
- Analysis of processing time durations for tasks running under control of the schedulers.
- Analysis of lattice structures for establishment of planned task precedences.

Scheduler algorithm models have been developed which result in the ability to predict sequences of task executions. The task sequences depend upon processing time durations for tasks running under the scheduler, and upon the priorities imposed on the tasks by the lattices in which they occur. Tasks are represented by equations for their processing times as functions of the instantaneous processing loads produced by the operating environment.

3.2.2 Task Models

3.2.2.1 General

Task models are represented where feasible by equations of the form

$$T = K_0 + K_1 F_1 + K_2 F_2 + \dots + K_n F_n$$

where: T is the processing time for the task

F_n is the value of an environmental factor (e.g., number of target reports processed, or number of data blocks displayed)

K_n is a constant.

In cases where the above form is not suitable, and in cases where the processing times have small means and small variances, task processing times are given as means and standard deviations.

The task equations were developed through an iterative process which included

- Analysis of ARTS IIIA design data.
- Development of a list of system load factors which have the potential of influencing task processing times.
- Development of a data extraction software package to support measurement of task processing times and potential load factors.
- Measurement of processing times and load parameters, using the New York TRACON and the ARTS IIIA system in the SSF at NAFEC.
- Analysis by linear regression of the measurement results in order to produce task equations.
- Critique of the regression results based on understanding of the system design.
- Refinement of equations for 1980 based on the critique.

- Modification of the 1980 equations to account for the impact of functions added in future years.

Data were also collected during this process to be used in characterizing processing time spent for overhead activities.

Analysis of the software design for each task module focused primarily on input and output parameters and the logical flow of the processing. Input and output parameters were analyzed in order to develop an initial list of candidate load factors for each task. Examination of the logical flow enabled judgments to be made as to which candidate factors appeared to have important influence on processing time and which did not. Evidence of major program loops and data base searches on large arrays were considered guides to judge the significance of data elements on process time. Computational details were not considered.

The result of the design analysis was a list of data elements to be counted along with task processing times while exercising the New York version of the program. Those data elements are shown in Table 3.2-1.

The list of tasks which were measured is shown in Table 3.2-2.

Three forms of output data were produced: statistical summaries of processing times; tabulations, for each lattice processed, of the quantities of data processed and of the task processing times; and histograms of the processing activities of each active processor.

For each run the statistical summary data show

- For each task
 - Number of measurements
 - Average time (mils)
 - Minimum time
 - Maximum time
 - Standard deviation
 - Variance

TABLE 3.2-1 DATA EXTRACTION PARAMETERS FOR PROCESSING
LOAD MEASUREMENTS

<u>Task</u>	<u>Definition</u>
ADB	Altitude data blocks
AT	Associated tracks requiring display change
ATB	Associated tracks with beacon codes
ATC	Associated tracks with mode C
ATD	Associated tracks with discrete beacon
ATH	Associated tracks in handoff
BOR	Beacon only reports
CCT	Number of changes to CTS threads
DTT	Deviation trial tracks
FD	Full data blocks requiring display change
LD	Limited data blocks requiring display change
MD	MSAW data blocks requiring display change
NAT	Number of assoc threads updated
NCS	Number of changes to sector threads
NDT	Number of tracks flagged for delay terminations
NM	Number of tracks in the MSAW tab list
NPC	Number of tracks in the coast/suspend list
NPS	Tracks in the store list
NT	Number of tracks, total
NTT	Tabular lines
ROR	Radar only reports
RRR	Radar reinforced beacon reports
SEC	Sector number of given sensor
SNS	Sensor number
SS	Single symbols requiring display update
TA	Associated tracks - total
TAA	Number of assoc threads added
TAD	Number of assoc tracks displayed
TAF	Number of assoc tracks requiring a FDB update
TL	Tabular lines requiring display update
TO	Number of threads added/deleted
TSL	Number of tracks in the store list
TSS	Number of tracks requiring single symbol updates
TTT	Turning trail tracks

TABLE 3.2-1 DATA EXTRACTION PARAMETERS FOR PROCESSING
LOAD MEASUREMENTS (cont'd)

<u>Task</u>	<u>Definition</u>
TU	Number of unassociated tracks, total
TUD	Unassociated tracks displayed
TUF	Number of unassociated tracks required FDB update
TUL	Unassociated linked tracks, total
TUU	Unassociated unlined tracks, total
UBR	Unused beacon reports
URR	Unused radar reports
UT	Unassociated tracks requiring display update
UTB	Unassociated tracks, beacon
UTC	Unassociated tracks, mode C
UTD	Unassociated tracks, discrete beacon
UTL	Unassociated tracks requiring LDB update

TABLE 3.2-2 TASK DEFINITIONS FOR 1980 ARTS IIIA CONFIGURATIONS

<u>Task</u>	<u>Definition</u>
ALTRK	Altitude tracker
AUT	Automatic offset of display data blocks
CDR	Continuous data recording
CDT	Console data terminal
CRIT	Critical data recording
CTIP	Console typewriter input processing
DOP	Display output processing
EDISC	Disk control
IFI	Interfacility input
IFO	Interfacility output
KOFA	Keyboard operational functions
MAT	Flight plan tab list data monitor
MSAW	Minimum safe altitude warning
MSP	Medium speed printer control
MTP	Magnetic tape processing
PAUS	Track display data output control
PDOP	Periodic display output processing
PSRAP	SRAP input processing
RDOP	Remote display output processing
RKIP	Remote keyboard input processing
RTDOP	Remote tabular display output processing
SCTME	Scratch pad display monitor
SLINK	Inter-sensor track link
SWABS	Software adaption to beacon system
TCRSS	Track cross reference
TDOP	Tabular display output processing
TEDC	Track early discrete correlation
TEEXEC	Tracking executive
TINIT	Track initialization
TPRED	Track prediction
TPSEC	Primary/secondary correlation
TPUR	Process unused reports
TROUT	Track output
TUDS	Sector thread update
TUD	Thread update

- For each processor
 - Number of planned task measurements
 - Average, minimum, maximum, standard deviation and variance of process times (mils) for planned tasks
 - Number of popup task measurements
 - Average, minimum, maximum, standard deviation and variance of process times for popups
 - Percent of total processing time used for planned tasks popup tasks, dead time, inactive time, idle time and overhead.

Appendix K contains the statistical summaries of measurements taken at the New York TRACON and at NAFEC in the SSF.

Eight runs were taken at New York. Four methods of data input were used:

- Capacity scenario. Developed by UNIVAC, this scenario generates 500 targets, consisting of a mixture of radar and beacon targets, each moving in a small circle at 60 knots. The targets are spatially distributed more or less uniformly around the four New York sensors and have ranges great enough that there was little change in bearing from any sensor. Approximately 1200 tracks are generated from the targets, including associated and unassociated tracks.
- Modified capacity scenario. Capacity scenario modified by Sterling to cause targets to move in a constant direction (90°) at a greater speed (150 knots) to force sector and track thread changes, track initiation, trial track generation, and variations in spatial distribution of tracks.
- Live data. Two samples were taken: one with all tracks unassociated, and one with some tracks manually associated.
- Sterling scenario. A scenario containing a small number of targets concentrated in a small volume of space, with some targets descending in altitude. This scenario allowed extreme variation in spatial distribution and produced a load for MSAW processing.

Table 3.2-3 lists these data sets. Exhibit 3.2-1 shows the data format for measurement of processing loads and task times. Exhibit 3.2-2 illustrates the format for histograms of IOP processing.

3.2.2.2 Existing Functions

The statistical summaries were used to select tasks which accounted for major amounts of processing time. These tasks were subjected to analysis by linear regression in order to develop equations to represent their processing times. Tasks analysed by regression are listed in Table 3.2-4 along with the regression results.

The regression result for PAUS represents the cumulative time for seven logical copies of the task in one lattice execution. The expression $0.6 (TAF)^2$ was ultimately eliminated from the PAUS model because no basis for it could be found in the design data and because its contribution to the total time is small. Discussions with UNIVAC personnel resulted in replacement of the constant term (45.7) with a function which is proportional to the CTS size.

The number of single symbols updated cannot be predicted directly. Estimation of the number of single symbol updates is based on the following assumptions:

- The number of single symbols updated on any display is equal to 0.25 (unassociated tracks) for the radar to which the display is associated.
- The total number of single symbols for any radar is the sum of the single symbols on all its displays.
- The number of single symbols updated during any lattice is proportional to the time duration of the previous lattice.

The equation for PAUS which results from this analysis is

$$\sum_{p=1}^P t(p) = 0.0381(CTS) + 0.425(t_L)(T1)$$

$$\text{where } T(1) = \sum_{j=1}^{\#SNSR} \frac{1}{ts(j)} \sum_{k=1}^{32} [TU(j,k)] [\#Displays(j)]$$

TABLE 3.2-3 ARTS IIIA MEASUREMENT DATA TAKEN
AT NY TRACON

RUN #	DATE	SCENARIO	NOTES
1	7/3/79	Capacity	
2	7/3/79	Live	All Targets Unassociated
3	7/3/79	Live	Some Associated Targets
5	7/4/79	Modified Capacity	All Tracks Unassociated No Keyboard Entries
6	7/4/79	Modified Capacity	Some Associated Tracks Keyboard Entries Enabled
7	7/5/79	Modified Capacity	
8	7/4/79	Sterling Scenario	

[illegible]

TABLE 3.2-4 REGRESSION ANALYSIS RESULTS

PAUS	$t = 45.7 + 0.6(\text{TAF})^2 + 1.7(\text{SS})$ [total time for all copies of PAUS]
SLINK	$\bar{t} = 8.2 \quad \sigma = 2.7$
TCRSS	$t = 3.7 + \text{TU} + 0.2(\text{TA})^2$
TEDC	$t = 1.7 + 0.55(\text{ATD} + \text{UTD}) + 0.2(\text{TA})(\text{TU})$
TPRED	$t = 3.1 + 1.3(\text{TA} + \text{TU})$
TPSEC	$t = 7.8 + 0.5(\text{TU}) + 0.2(\text{TA})(\text{TU})$
TPUR	$\bar{t} = 11.9 \quad \sigma = 10.9$
TUDS	$\bar{t} = 7.9 \quad \sigma = 6.9$
TUD	$\bar{t} = 4.5 \quad \sigma = 5.9$

TU = unassociated tracks
j = sensor ID
k = sector ID
 t_L = execution time of previous lattice
 t_s = sensor scan time.

No basis could be found in the system design for the term $0.2(TA)^2$ in the equation for TCRSS. This term also appears to have only a small influence on the process time for TCRSS since the number of associated tracks is normally small compared to the number of unassociated tracks. The term was, therefore, eliminated from the TCRSS equation.

The same reasoning led to the elimination of the term $0.2(TA)(TU)$ from the equation for TPSEC.

No correlation was found between the processing times for SLINK, TPUR, TUDS or TUD and the processing load. The mean and standard deviations were taken as the final models for SLINK and TPUR.

Discussions with UNIVAC personnel, however, led to the assumption that the times for TUDS and TUD are proportional to the CTS size. The final models for these tasks then became

For TUDS
 $t = 0.0066(CTS)$

For TUD
 $t = 0.0038(CTS)$

Small means and small variances were indicated by the statistical summaries for the tasks ALTRK, AUT, CDR, CRIT, DOP, MAT, MSAW, MTP, PDOP, RKIP, RTDOP, SCTME, SWABS, TEXEC, TINIT and TROUT. It was decided that tasks with short, nearly constant processing times could be adequately modeled by their mean times and standard deviations. Therefore, to save effort, no regression analysis was performed on the measurement results for these tasks.

For some of these tasks, however, analysis of the software design led to the conclusion that the processing times depended on hardware configuration parameters which did not vary during the measurement runs. In those cases, the process time models were adjusted to reflect the dependence:

- DOP $t = 1.4(\#MDBMs)$
- PDOP $t = 0.6(\#MDBMs)$
- RDOP $t = 2.4(\#RDBMs)$
- RKIP $t = 1.3(\#RDBMs)$
- RTDOP $t = 0.6(\#RDBMs)$
- TDOP $\sum_{t=1}^I t(i) = 2.9(\#MDBMs) \quad (I = \#executions/lattice)$
- TEXEC $t = 0.5(\#sensors)$

There was insufficient information to develop potential load factors for the tasks IFI, IFO, KOFA, CDT, CTIP, PSRAP and MSP. These tasks, except for IFI, were then modeled by their mean times and standard deviations. IFI was estimated to have a means time of 5 mils.

The above analysis led to the processing time models for the year 1980 shown in Table 3.2-5 as processing times for each execution of the tasks.

All planned tasks are initiated in every lattice. Some of them, however, may be initiated under circumstances in which there is no load to be processed. In these circumstances, the tasks bypass their normal logical flow and exit quickly. Tasks of this type include most tracking tasks, as well as PDOP and MAT. Models for these times are shown in Table 3.2-5 under the column "Process Time (Mils) When Initiated But Not Executed".

Statistics for overhead processing are also included in Table 3.2-5. They were obtained by use of the overhead times indicated in the processor utilization histograms.

TABLE 3.2-5 PROCESSOR UTILIZATION MODELS (1980)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
AL TRK	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 2.6 \quad \sigma = 0.4$	$\bar{t} = 1.3 \quad \sigma = .325$
AUT	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.5$	
CDR	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
CRIT	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
DOP	1/Lattice	1/Lattice	$t = 1.4(\#MDUMs)$	
IF1	1/Lattice	1/Lattice	$\bar{t} = 5.0 \quad \sigma = 0.0$	
IF0	1/Lattice	1/Lattice	$\bar{t} = 8.3 \quad \sigma = 1.6$	
KOFA	1/Lattice	1/Lattice	$\bar{t} = 5.4 \quad \sigma = 4.3$	
MAT	1/60 Seconds	1/Lattice	$t = 0.001(\text{CTS Capacity})$ $(t_{MAX} = 32)$	$\bar{t} = 1.25 \quad \sigma = 0.452$
MSAW	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 1.8 \quad \sigma = 1.0$	$\bar{t} = 1.8 \quad \sigma = 1.0$
MTP	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
PAUS	P/Lattice (P=#Processors)	P/Lattice	$x_t(p) = 0.0381 (\text{CTS}) + 0.425(t_L)(T1)$ $p = \sum_{j=1}^{\#Snsr} \sum_{k=1}^{32} \bar{t}_{S(j,k)} \left[\#Displays(j) \right]$ $T1 = \sum_{j=1}^{\#Snsr} \sum_{k=1}^{32} \bar{t}_{S(j,k)} \left[\#Displays(j) \right]$	
<p>TU = Unassociated Tracks j = Snsr ID k = Sector ID t_L = Execution Time of Previous Lattice t_S = Sensor Scan Time</p>				

TABLE 3.2-5 PROCESSOR UTILIZATION MODELS (1980) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
PDOP	4/Second	1/Lattice	$t = 0.6(\#RDBMs)$	$\bar{t} = 1.7 \quad \sigma = 1.3$
RDOP	1/Lattice at Sites with RDBMs	1/Lattice at Sites with RDBMs	$t = 2.4(\#RDBMs)$	
RKIP	1/Lattice at Sites with RDBMs	1/Lattice at Sites with RDBMs	$t = 1.3(\#RDBMs)$	
RTDOP	1/Lattice at Sites with RDBMs	1/Lattice at Sites with RDBMs	$t = 0.6(\#RDBMs)$	
SCTME	Detroit: 1/Lat NY: 3/Lat CHI: 3/Lat LA: 3/Lat	Detroit: 1/Lat NY: 3/Lat CHI: 3/Lat LA: 3/Lat	$\sum_{i=1}^I t(i) = 9.0011(\text{CTS Capacity})$ $I = \# \text{Executions/Lattice}$	
SLINK	1/Lattice at Multisnr Site	1/Lattice at Multisnr Site	$\bar{t} = 8.2 \quad \sigma = 2.7 \quad (t_{MAX} = 80)$	
SWABS	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 1.0 \quad \sigma = 0.0 \quad (t_{MAX} = 64)$	$\bar{t} = 1.0$
TCRSS	1/Sector/Snsr	1/Lattice/Snsr	$t = 3.7 + TU \quad (t_{MAX} = 90)$ $TU = \# \text{Unassociated Tracks in Sector Processed}$	$\bar{t} = 3.1 \quad \sigma = 1.3$
TUOP	NY: 5/Lattice CHI: 3/Lattice LA: 2/Lattice DET: 1/Lattice	NY: 5/Lattice CHI: 3/Lattice LA: 2/Lattice DET: 1/Lattice	$\sum_{i=1}^I t(i) = 2.9(\#RDBMs)$ $I = \# \text{Executions/Lattice}$	
TEOC	1/Sector/Snsr	1/Lattice/Snsr	$t = 1.7 + 0.55(ATD+UTD) + 0.2(TA)(TU)$ $(t_{MAX} = 60)$ $ATD = \# \text{Discrete Associated Tracks}$ $UTD = \# \text{Discrete Unassociated Tracks}$	$\bar{t} = 3.5 \quad \sigma = 2.5$

TABLE 3.2-5 PROCESSOR UTILIZATION MODELS (1980) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
TEKEC	1/Lattice	1/Lattice	$t = 0.5(\#SNSRs)$	
TINIT	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 4.0 \quad \sigma = 4.1 \quad (t_{MAX} = 200)$	$\bar{t} = 3.2 \quad \sigma = 1.9$
TPRED	1/Sector/Snsr	1/Lattice/Snsr	$t = 3.1 + 1.3(TA+TU)$ $TA = \#Associated Tracks in Sector Processed$	$\bar{t} = 3.3 \quad \sigma = 1.8$
TPSEC	1/Sector/Snsr	1/Lattice/Snsr	$t = 7.8 + 0.5(TU)$	$\bar{t} = 3.4 \quad \sigma = 1.8$
TPUR	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 11.9 \quad \sigma = 10.9 \quad (t_{MAX} = 90)$	$\bar{t} = 3.2 \quad \sigma = 1.9$
TROUT	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 3.3 \quad \sigma = 1.7$	$\bar{t} = 2.9 \quad \sigma = 1.9$
TUDS	1/Lattice	1/Lattice	$t = 0.0066(CTS Capacity)$	
TUD	1/Lattice	1/Lattice	$t = 0.0038(CTS Capacity)$	
CDT	Prd = 1.3 Sec $\sigma = 0.79 Sec$	Random Popul	$\bar{t} = 3.6 \quad \sigma = 1.7$	
CTIP	Prd=0.049 Sec	Periodic Popul	$\bar{t} = 1.8 \quad \sigma = 0.6$	
EDISC	Prd=48.1 Mils $\sigma = 35.8 Mils$	Random Popul	$t = 0.0025(CTS Capacity)$	
IFI	Prd=19.2 Sec $\sigma = 4.7 Sec$	Random Popul	$\bar{t} = 1.0 \quad \sigma = 0.0$	
KIP	Prd=64.9 Mils	Periodic Popul	$t = 0.98(\#DBMs)$	
PSRAP	Prd=70.7 Mils	Periodic Popul	$\bar{t} = 19.5 \quad \sigma = 8.0 \quad (4 Snsr Sites)$ $\bar{t} = 9.8 \quad \sigma = 5.7 \quad (2 Snsr Sites)$ $\bar{t} = 4.9 \quad \sigma = 4.0 \quad (1 Snsr Sites)$	
MSP	Prd=48.6 Mils $\sigma = 26.4 Mils$	Random Popul	$\bar{t} = 4.0 \quad \sigma = 2.6$	

TABLE 3.2-5 PROCESSOR UTILIZATION MODELS (1980) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
Overhead for Task Initiation	Before Each Task		$\bar{t} = 0.33 \quad \sigma = 0.5$	
Lattice			$t_{\text{TIMEOUT}} = \begin{cases} 130 & \text{if Procsg on Schedule} \\ 110 & \text{if 1 Sector Late} \\ 85 & \text{if 2 Sectors Late} \\ 60 & \text{if 3 Sectors Late} \\ 35 & \text{if 4 Sectors Late} \end{cases}$ <p>Lattice Execution Time is Compared to Timeout Value and Lattice is Terminated Only During Task PAUS.</p>	

Task models for future years are described in Appendix L and are discussed in Section 3.2.2.3.

There was some concern about the possibility that the task processing times may be significantly influenced by a change in the number of processors. To resolve this issue, a set of measurements was conducted at the SSF. These measurements were conducted with the following combinations of processors and displays using the modified capacity scenario:

#IOPs	#Displays
7	46
7	38
7	32
7	20
5	46
5	20

The number of processors was changed from seven to five by reconfiguring the system to place two IOPs off line.

The actual number of physically connected displays did not vary, since only a small number of displays (5) was connected. The display variation for the experiment was affected by modification of the list of logical displays in the ARTS IIIA data base, causing PAUS to process output data only for those displays on the list.

Arguments for the possibility of processing time changes resulting from variations in the number of processors are based on the proposition that contention for access to memory locations causes increases in processing times as the number of processors increases. If this proposition is true, then processing times for measurements using seven processors can be expected to be greater than for processing times with five processors, with the number of displays held constant.

Tables 3.2-6 and 3.2-7 show the mean times and standard deviations, respectively, for each task for each combination of processors and displays. Although these data do not provide a complete and accurate indication of the effects of memory contention, there appears to be no tendency for processing times to be overwhelmingly affected by the number of processors. (Note that the model development process effectively built memory contention into the task equations, since measurements were performed on a 7 active IOPs by 14 active MMs system.)

The CDR function was modified during the measurements to allow recording of process times and other parameters related to the tests onto the system disk. The magnitude of the influence of normal CDR on the task processing times cannot be determined since modification of CDR is essential for the system measurements. However, timing measurements conducted by UNIVAC on the Tampa processing system indicate that the processing times for several important tasks may be influenced by the execution of CDR. The following data represent percent of an IOP used for processing some tasks at Tampa with four active IOPs and a 480 track scenario.

Task	% of an IOP	
	Without CDR	With CDR
PSRAP	.68	3.28
KIP	14.41	17.00
TPRED	14.69	20.21
ALTRKR	4.06	7.55
MTG	1.86	5.84

Changes in processing times for other tasks were small - generally in the range of ± 1 percent of an IOP. The combined effect for all tasks was an increase of 10 percent of an IOP when CDR was processed.

TABLE 3.2-6 MEAN TASK PROCESSING TIMES WITH VARIATIONS
IN THE NUMBER OF PROCESSORS AND DISPLAYS

IOPs	7				5	
	46	38	32	20	46	20
ALTRK	2	2	2	2	2	2
AUT	1	1	1	1	1	1
CDR	1	1	1	1	1	1
CRIT	3	3	3	2	3	2
DOP	4	4	4	3	4	2
IFI	1	1	1	1	1	1
IFO	8	8	9	9	8	8
KOFA	8	7	4	4	7	4
MAT	3	3	1	1	2	1
MSAW	2	2	2	2	2	1
MTP	1	1	1	1	1	1
PAUS	19	17	17	11	21	12
PAUS 1	22	20	20	13	27	14
PAUS 2	20	18	18	12	17	10
PDOP	4	3	4	2	4	3
RDOP	12	12	11	10	13	12
RKIP	4	4	4	4	4	3
RTDOP	4	5	5	4	4	4
SCTME	1	1	1	1	1	1
SLINK	8	9	8	8	9	8
SWABS	1	1	1	1	1	1
TCRSS	6	6	6	5	8	6
TDOP	7	8	8	7	7	7
TDOP 1	7	8	8	7	7	7
TEDC	10	10	9	8	13	10
TEEXEC	2	2	2	2	2	2
TINIT	4	4	4	3	4	3
TINIT 1	3	3	2	2	3	2
TPRED	8	8	7	7	10	7
TPSEC	6	6	5	5	7	6
TPUR	2	2	2	2	3	2
TROUT	3	3	3	3	3	3
TROU 1	2	2	2	2	3	2
TUDS	7	7	6	5	8	6
TUD	4	3	3	1	3	2
CDT	6	6	2	2	6	5
CTIP	2	1	1	2	1	1
EDISC	4	4	4	4	4	4
KIP	13	11	13	10	12	10
MSP	0	0	3	3	0	0
PSRAP	8	7	7	7	8	6

TABLE 3.2-7 STANDARD DEVIATIONS OF TASK PROCESSING TIMES
WITH VARIATIONS IN THE NUMBER OF PROCESSORS AND DISPLAYS

IOPs	7				5	
Displays	46	38	32	20	46	20
ALTRK	1	1	1	1	1	1
AUT	0	0	0	0	0	0
CDR	0	1	0	0	0	0
CRIT	9	10	10	8	11	10
DOP	1	1	2	2	1	0
IFI	0	0	0	0	0	0
IFO	2	2	2	1	2	2
KOFA	13	12	0	1	10	0
MAT	6	6	2	1	3	2
MSAW	1	1	1	1	1	1
MTP	0	0	0	0	0	0
PAUS	13	10	12	6	18	11
PAUS 1	12	9	12	5	15	10
PAUS 2	11	8	12	5	18	10
PDOP	4	3	4	2	4	2
RDOP	3	3	3	4	1	2
RKIP	1	1	1	0	0	0
RTDOP	1	1	1	1	1	1
SCTME	1	2	2	2	2	1
SLINK	4	5	3	4	5	4
SWABS	0	0	0	0	0	0
TCRSS	7	7	6	6	7	6
TDOP	1	2	1	1	1	1
TDOP 1	1	2	1	1	1	1
TEDC	13	13	13	12	14	13
TEXEC	1	1	1	1	1	1
TINIT	5	4	4	3	5	3
TINIT 1	3	3	3	3	4	3
TPRED	8	8	8	8	7	7
TPSEC	5	5	5	5	5	5
TPUR	4	4	4	4	4	4
TROUT	1	1	1	2	1	1
TROU1	1	1	1	1	1	1
TUDS	6	6	5	5	6	5
TUD	5	4	3	3	4	3
CDT	1	1	0	0	1	1
CTIP	0	0	0	0	0	0
EDISC	5	5	5	5	5	5
KIP	2	2	3	2	1	1
MSP	0	0	1	1	0	0
PSRAP	4	3	3	3	5	3

The above results cannot be used to quantify the impact of CDR on processing times estimated in the current study. However, they do imply a possible increase in processing times of some tasks when CDR is executed.

3.2.2.3 Future Functions Impact

This section presents a set of assumptions which constitute the bases for estimation of the impact on ARTS IIIA processing requirements of the future implementation of the following systems:

- Terminal Conflict Alert (Stage A)
- Terminal Metering and Spacing
- ARTS/DABS integration
- ARTS/TIPS interface
- Tower Automated Ground Surveillance
- Full Digital ARTS Display
- Tower Cab Digital Display.

The sources of information on which these assumptions and estimates are based are sparse. Therefore, the estimates are very approximate and should only be interpreted as providing insight into the order of magnitude of ARTS resource requirements.

3.2.2.3.1 Terminal Conflict Alert (CA)

It is assumed for this study that the CA function will be implemented at all sites in 1982 to provide service for controlled aircraft which are beacon equipped and reporting Mode C.

Various time estimates are available from studies conducted by MITRE and UNIVAC [28, 29, 30] at single and dual beacon sites. Although the quantitative results vary widely because of differing assumptions concerning aircraft densities and overhead processing, the equations used for estimation are all of the form

$$t = AN^2 + BN + C$$

where N is the number of aircraft eligible for CA processing, and A depends strongly on aircraft density. The method of estimation used in this study follows a similar approach.

As a result of discussions with UNIVAC, the CA function is assumed to be processed in the following planned tasks.

- TUDX - A single task which performs thread update. This task is parallel to TUDS and TUD in the lattice structure, is similar to them in operation and executes each lattice. Discussions with UNIVAC led to the conclusion that the timing for TUDX will likely be similar to that of TUDS. As a result, the timing model for TUDS was also adopted for TUDX.
- CA - One logical copy per sensor will provide conflict detection. All copies are successors to TEXEC, TUDS and TUDX in the planned lattice. Each copy executes once per sector for its assigned sensor. The timing model for this task is assumed, as a result of discussions with UNIVAC, to be of the form $t = AN^2 + BN$.
- CATRK - One logical copy per sensor will perform CA tracking. Each copy is a successor to one copy of the CA task. UNIVAC estimates 2 mils per track for processing time.
- CATU - A single task which acts as a data base manager. This task is executed after all copies of CA which are eligible to execute because of sector advances. UNIVAC estimates a mean processing time of 2 mils per execution.

Following the above analysis, the processing times for CA tasks are estimated to be described by

<u>Task</u>	<u>Process Time Model</u>
TUDX	$t = 0.0066(\text{CTS})$
CA	$t(j) = 0.0015 \left[\sum_{k=1}^{32} \text{CTA}(j,k) \right]^2 + 0.084 \sum_{k=1}^{32} \text{CTA}(j,k)$ <p> $j = \text{sensor ID}$ $k = \text{sector ID}$ $\text{CTA} = \text{\#associated tracks of Mode C beacon equipped aircraft plus unassociated linked tracks}$ </p>
CATRK	$t(j) = 2 \left[\text{CTA}(j,k) \right]$
CATU	$\bar{t} = 2$

3.2.2.3.2 Terminal Metering and Spacing (M&S)

M&S was initially assumed to be a planned task which takes the following amount of process time 32 times per scan [adapted from Reference 18]

$$t = 0.11 + 1.35(N_0 + N_f) + 2.7N_i$$

where N_0 = Number of active aircraft outside the feeder fix

N_i = Number of active aircraft inside the feeder fix

N_f = Number of flight plans or suspend status tracks

Subsequent discussions with UNIVAC and FAA personnel led to a revision of the M&S timing equation to

$$t = 0.11 + 2.2N_i$$

In the current study, N_i is interpreted to include controlled, arriving aircraft. Controlled, arriving aircraft are estimated to constitute 75% of the associated tracks during a busy period.

M&S is modeled in this study as a periodic popup task, MSPOP, which executes 32 times during the period of one radar scan. One logical copy of MSPOP performs

processing for all sensors in a multisensor system. Its processing time per execution is related to the number of associated tracks on all sensors by the following equation

$$t = 0.11 + 1.7 \sum_{j=1}^{\#SNSR} \sum_{k=1}^{32} TA(j,k)$$

where j = sensor ID

k = sector ID

An earlier attempt in this study to model the M&S function was based on the assumption that M&S might be separated into two roughly equal parts, one executed by a planned task and the other by a popup. The planned task turned out to cause the lattice processing times to be too long, however, and was abandoned.

M&S is also expected to cause a slight increase in display processing time. It is assumed that increase in PAUS processing time will occur which is proportional to the number of M&S data elements displayed, but is independent of the existing PAUS processing time. The increase in PAUS processing time is assumed equal to the amount $0.84(TA)$, where TA is the number of associated tracks processed.

3.2.2.3.3 ARTS/DABS Integration

ARTS/DABS integration will cause major changes to ARTS IIIA lattices. DABS will perform scan-to-scan correlation at the sensor site, thus allowing ARTS IIIA to become a noncorrelating system. In addition, unused reports will be virtually eliminated.

Thus, it is assumed that the following planned tasks can be removed from the lattice

TPUR, TCRSS, TPSEC.

TEDC is assumed to remain in the system after DABS integration to perform correlation, correction, and prediction. TPRED is assumed to remain to perform auto drop and coast.

However, all tracks will be processed by TEDC after DABS integration, whereas it currently processes discrete beacon tracks only. The processing time per track for TEDC is expected to increase by about 50% due to replacement of the TOS tracker with a TABG tracker. This new expanded version of TEDC has been renamed "DABC" to distinguish it from the current version.

3.2.2.3.4 ARTS/TIPS Interface

Since TIPS will be implemented with its own processing and display, its impact on ARTS IIIA processing will be minimal. The IFI and IFO tasks are expected to expand to account for increased message traffic. After implementation of the ARTS/DABS interface, IFO and IFI are estimated to require 10 mils each per execution. A negligible increase in processing time will be caused by implementation of a new popup task to execute for approximately 20 mils only upon depression of the alternate data switch.

3.2.2.3.5 Tower Automated Ground Surveillance (TAGS)

TAGS is expected to be an independent system employed in busy airports to perform ground tracking and conflict alert. Its processing and storage requirements are expected to be extremely large (on the order of M&S with added tracking). For these reasons it would seem difficult and unnecessary to merge TAGS processing into the ARTS IIIA system. Therefore, it is assumed that TAGS would employ its own processors and displays and would have negligible impact on ARTS IIIA processing.

3.2.2.3.6 Full Digital ARTS Displays (FDAD)

FDAD will be very similar to a full-digital TI DEDS or TCDD with an internal RDBM operating over a parallel interface to the IOP instead of a serial interface to a CMC. Therefore adding the FDAD to ARTS IIIA is very similar to adding the RDBM/TCDD combination.

The new tasks added for the RDBM/TCDD include:

1. RKIP* - Remote Keyboard Input Processing
2. RDOP* - Remote Display Output Processing
3. MOP - Map Output Processing

4. RTDOP*- Remote Tabular Display Output Processing
5. PUTT - Process Untracked Targets

The microprocessor in the FDAD will cause keyboard input processing to be more similar to RKIP than to KIP.

Output processing for the FDAD will be more similar to DOP than to RDOP since the parallel interface of the FDAD is more similar to the parallel interface to an MDBM than it is to the serial interface to an RDBM. Therefore, the estimates for DOP and RDOP before the implementation of FDAD should remain valid.

MOP is a new task which is necessary in a system with digital displays. It outputs a new map to a display when requested by keyboard entry. Since it is executed so seldom, its effect on system timing should be negligible.

Because of the microprocessor integrated into the FDAD, tabular display processing should more resemble RTDOP than TDOP.

PUTT is a new task which displays all untracked target reports in order to simulate video. This task must execute once per sector per sensor as a post-task of TPUR. Therefore, PUTT must be added to the lattices as a post-task of TPUR. One copy of PUTT should be used for each copy of TPUR. PUTT execution time may be estimated at 1 msec per sector per sensor. It should be noted that because of this requirement, the sensor (eg., SRAP, DABS) must send all target reports to the IOP including false target reports.

PAUS will also be significantly affected by the FDAD. The track symbology required on a full-digital display is much more complicated than that on a

*These tasks are also required for the RDBM/BRITE display combination and are already present in the New York Tracon system.

time-shared display. This difference is illustrated below:

Time-Shared Symbolology

- Controller symbol displayed at current scan reported position

Full Digital Symbolology

- Dash displayed at current scan reported position
- Controller symbol displayed 1/16" above the dash
- History trails displayed at smoothed positions of up to the last 5 scans.

The cost of computing this more complicated symbolology is estimated at 200 msec per track per display per scan. The time used by PAUS is adjusted accordingly.

There are also minor impacts on several other programs. For example, TROUT will have additional duties related to history trail updates. However, these impacts should be minor and are, therefore, ignored at this time.

3.2.2.3.7 Tower Cab Digital Display (TCDD)

TCDD is expected to be implemented at control towers within 20 miles of ARTS IIIA sensor systems. Implementation of TCDD is expected to cause the planned tasks RDOP, RTDOP and RKIP to be required. Modification of the software to provide all-digital symbolology, maps, and processing of untracked targets are accounted for in the FDAD implementation impact analysis.

3.2.3 Scheduler Simulation

The ARTS IIIA multiprocessor executive scheduler is simulated by a stand-alone FORTRAN program (ARTSCD), which accepts operator inputs and provides printed output. The scheduler simulation produces a detailed record of the sequence and timing of all pertinent events concerning the running of tasks by an operational ARTS IIIA program. The running (and overhead) times of such tasks are simulated according to the models of the previous section. The scheduling procedures are adapted from the New York ARTS system.

The scheduler simulation outputs provide the raw data and statistics which allow evaluation of timing loads for an operational ARTS IIIA program.

Figure 3.2.3-1 shows a generalized flowchart of the simulation.

3.2.3.1 Simulation Concept and Outline

The scheduler simulation mimics the real-time action of an ARTS IIIA multi-processor executive in assigning (deassigning) tasks to processors and provides a control framework for the execution of these tasks and for evaluating computer loading.

A period of real-time, typically one radar scan time, is simulated during which appropriate system states are recorded and statistics are accumulated. This period is divided by the scheduler into a number of lattice executions. A current New York type of single lattice is utilized throughout and modified appropriately for other sites and epochs. The lattice is a list of planned tasks with precedence relations that determine which tasks are eligible for execution at any time, given the set of completed tasks at that time. In addition to planned lattice tasks, popup tasks can occur, which are a separate category outside of the lattice structure and whose execution is independent of the lattice restrictions and timing.

Planned tasks are independently classified as high or low priority. The executive maintains separate queues of eligible tasks for each priority. Tasks are added to queues when all immediately preceding tasks of the lattice have been completed. A task is removed when it is assigned to a processor for execution. High priority eligible tasks are assigned in preference to low priority eligible tasks.

Popup tasks are made eligible to run according to their assigned periods in the task models. Popup tasks have assignment priority alternating with planned tasks in each processor as long as tasks are continuously assigned. If such a processor is idle for an interval, the alternating pattern is restarted with a random phase.

FIGURE 3.2.3-1 ARTSCD, SCHEDULER SIMULATION GENERAL FLOW

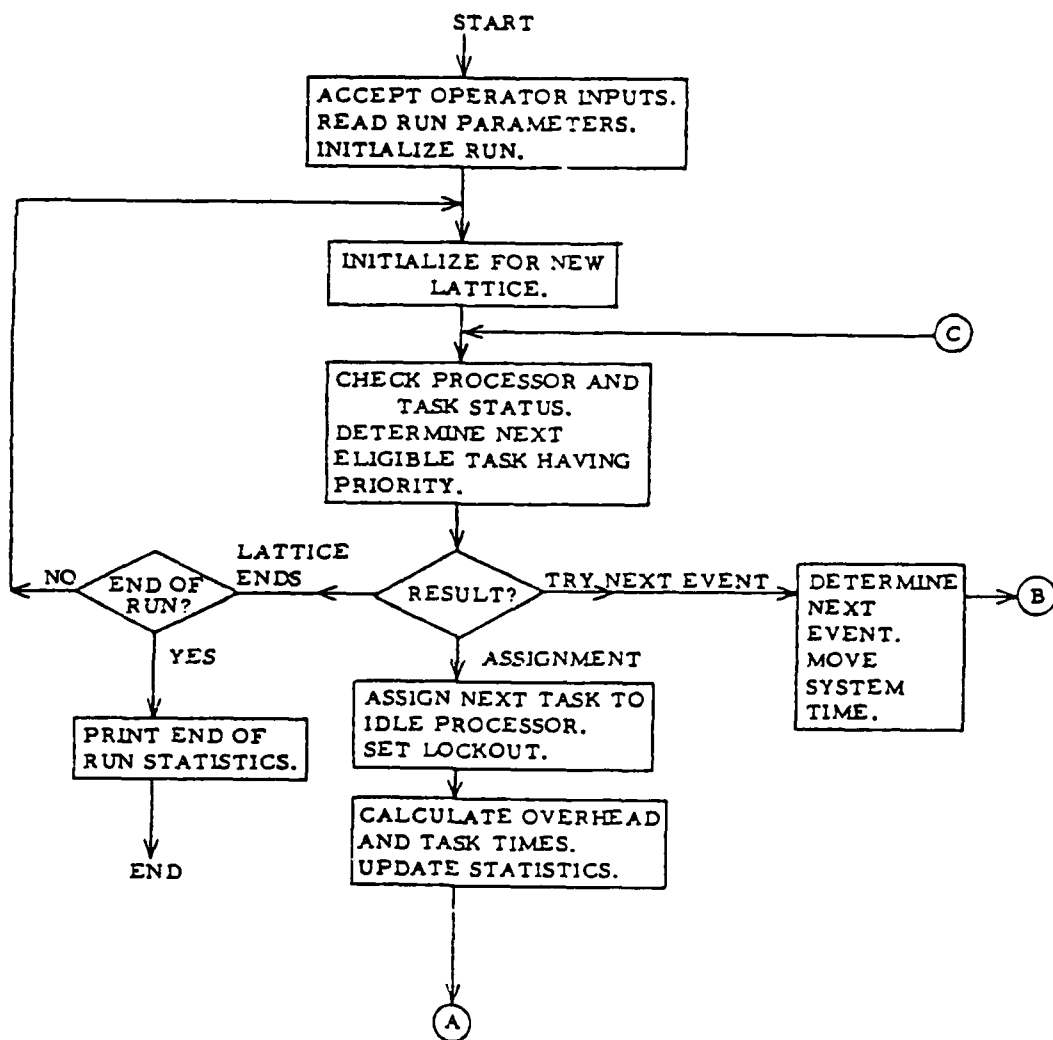
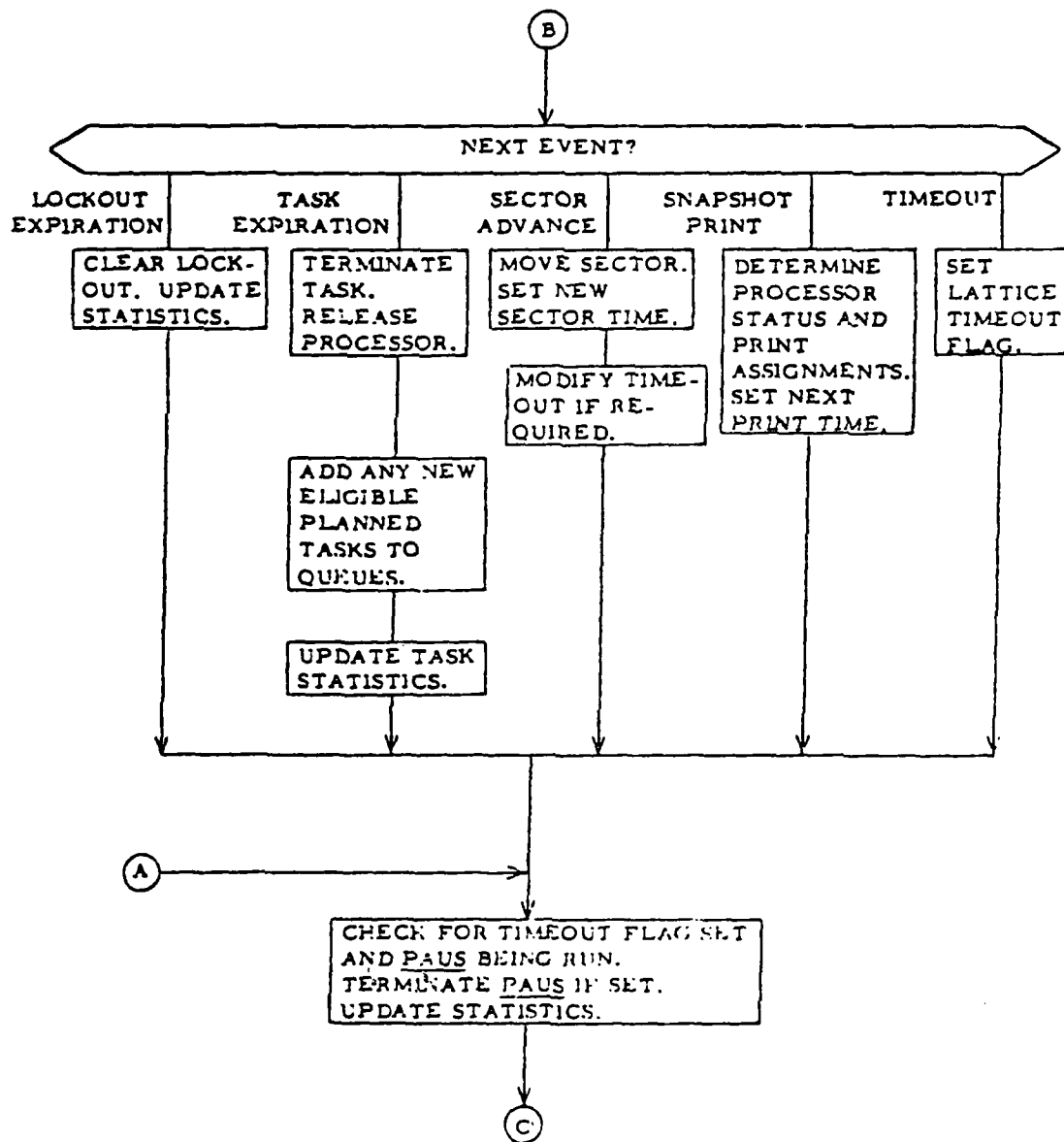


FIGURE 3.2.3-1 (Cont'd.)



When a task is assigned, the executive overhead time is calculated according to the overhead model, and the task execution time according to the task timing model. The processor is made busy with this task, but initially enters the overhead state. Task execution begins when the overhead time expires.

Some task timing models require traffic load inputs. These are determined from an aircraft track category table for each sensor which is tabulated in 32 radar sectors. The appropriate sector to be used at any time is found from a running determination of radar beam direction corrected by the sector processing lag for each task.

Some task timing models specify a total time for a set of tasks (copies) and require that each task of the set end at the same time (or nearly so). In these cases (PAUS, SCTME, TDOP), when the subsequent copies are assigned, any remaining time of the total is redistributed among all the assigned copies so that they end together. In the special case of PAUS, PAUS1 is normally forced to execute 10 mils beyond any other assigned PAUS copies. PAUS executions are terminated prematurely whenever the lattice runs too long and timeout, therefore, occurs.

The lattice terminates when all planned tasks have finished executing. A new lattice then begins immediately. Any popup tasks that have been assigned continue to execute across the lattice boundary.

The scheduler simulation is based upon an event driven logic. At each point in time the program maintains a list of next event times which are current and imminent. The earliest next event is determined, the state of the scheduler, the time and the event list are updated accordingly and the process continues. After each such event is processed, the program assigns available tasks by order of priority and lattice eligibility to idle processors according to scheduler sequencing logic and determines the overhead and running time of each new task. This defines new events for the event list.

The event list contains the following events (in the form of a time of next occurrence):

a. Executive Lockout Expiration

The scheduler model assumes that when a new task is assigned to an idle processor, the executive enters a state of lockout for a time determined from the executive overhead task model of Section 3.2.2. During lockout, no further tasks may be assigned to any idle processors. This event is created each time a new task is assigned and the lockout is cleared upon expiration.

b. Task Expiration (each active processor)

For each active processor a task expiration is calculated at the time a task is assigned by accounting for both the overhead and the task execution time determined from the timing models. When the task expiration occurs, the current task is deassigned and the processor becomes idle again.

c. Sector Advance (each sensor)

For each sensor in the system a record is kept of the next sector crossing time. When a sector crossing event occurs, the sensor state is updated and the next sector crossing time is calculated and inserted in the list. Sector crossing may modify lattice timeout time.

d. Output Print

In order to conveniently provide a simulation output option which consists of the state of each processor (tasks being run) at multiples of a uniform time interval, the simulation maintains an output event. When this event occurs (and other conditions are met) a printing of processor states occurs ("snapshot print") and the next output print time is calculated and inserted as a new event.

e. Lattice Timeout Limit

At the beginning of each lattice, the lattice timeout time is set here as 145 mils beyond the initial lattice time. Occurrence of a

lattice timeout results in setting a program flag which allows any PAUS tasks to be immediately terminated short of their normal end time.

This nominal 145 mils is shortened to 125, 100, 75, 50 mils if any sector advances occur which create data backlogs of, respectively, 2, 3, 4, 5 sectors for the worst sensor.

3.2.3.2 Simulation Inputs

The overall simulation is controlled by means of a console dialogue, while the details of the site case parameters are specified in a data file, which is read by the program.

The console dialogue allows the operator to make the following selections:

- The site case parameter file
- Length of run
- Snapshot print interval
- The first and last lattice of the block of lattices to be outputted by the snapshot print
- The number of processors to be assumed
- Either high or low traffic
- Optional print of the site case parameter information.

The site case parameter file specifies the following information:

- The site case data file number and title.

- The number of sensors, their periods and initial beam direction. The program assumes a number of track storage slots (CTS) equal to 300 times the number of sensors.
- The following processing and display equipment complements: number of processors, number of MDBM's, number of RDBM's, number of displays associated with each sensor. The program calculates the number of DBM's as the sum of all displays minus the number of RDBM's.
- The set of tasks defined for the site case. Each task is identified by name, is assigned a priority type (high planned, low planned or popup) and a parameter type. The parameter type is followed by the coefficients of the timing model for the task and controls the interpretation of these. In addition, the parameter type defines the correspondence between the various copies of a tracking task and their associated sensors.
- The lattice structure. Lattice structure is specified as an ordered list of all the planned tasks, where each task is accompanied by an ordered list of its successor tasks.
- Traffic counts for each sensor. Both high and low counts are provided, the selection to be made at run time. For each sensor the following traffic category numbers are supplied: total associated tracks, total unassociated tracks, discrete beacon associated tracks, discrete beacon unassociated tracks, mode C beacon equipped associated tracks, mode C cross-linked tracks. These numbers are obtained from the traffic load models of this study. The sum of the last two categories constitutes the conflict alert eligible tracks.

The program distributes these sensor track totals at random among 32 sectors in such a way that the counts are consistent (for example, the number of discrete beacon associated tracks in each sector is never greater than the total associated tracks for that sector).

In the special case of the New York validation run, the counts by sector are directly inputted in detail from the parameter file.

3.2.3.3 Simulation Outputs

The output of a run consists of the lattice snapshot print and the summary statistics. In addition, timeout and overload conditions are printed when they occur for any lattice. These outputs are prefaced by run parameter information.

The lattice snapshot print is an output of the state of each processor in the system at specific instants of time. These instants are integral multiples of a selected print time increment which occur during execution of a selected set of consecutive lattices.

If a processor is busy running a task, the state of the processor is denoted by printing the task name. If a processor is in executive overhead or is idle with no assigned task, while some other processor is in overhead, then those processors are considered to be in the overhead state, and ****OVHD**** is printed for each. If a processor is idle (and not in the overhead state) and all planned tasks for this lattice have been or are being executed, then that processor is in the inactive state and ****INAC**** is printed. If a processor is idle (and not in the overhead state) and is not inactive, then that processor is in the dead state and ****DEAD**** is printed. These rules provide an exhaustive definition of processor states.

The processor states are printed in blocks, each one lattice long. A summary of execution time, beginning and ending time is given for each lattice.

The summary statistics contain the following information accumulated for the entire run:

- The total number of lattices executed and the total run time.
- The mean and standard deviation of the lattice execution time over all lattices of the run.

- The percent average processor utilization time for each processor (and total, averaged over processors) occupied by:
 - 1) planned tasks, 2) popup tasks, 3) overhead state, 4) dead state, 5) inactive state.
- The mean execution time, standard deviation and number of calls for each defined system task.

Whenever timeout occurs of a given lattice, a message is printed which contains the following information: 1) the lattice number, execution time, beginning and ending time, 2) the number of sectors lag in processing and 3) the percentage completion of PAUS processing for this lattice and the total PAUS time requirement.

If the sector lag becomes 16 or greater, the run is terminated and a special termination message is printed.

3.2.4 Lattices

The scheduler lattices used in this study are adapted from the current New York ARTS. A single lattice is defined for each combination of site: New York, Chicago, Los Angeles, Detroit and year: 1980, 1982, 1984, 1986, 1988, 1990. The validation run is made with the NY 1980 lattice. The years beyond 1980 incorporate new functions in a hypothetical way.

In this section, the term lattice is used in a broad way to include all of the following:

- An ordered list of planned tasks defined for the system.
- The priority of each planned task, high or low.
- An ordered list of (immediate) successor tasks for each planned task.
- An ordered list of popup tasks.

This information allows the scheduler to determine the order of assignment of tasks to idle processors.

When a lattice is loaded at the start of a scheduler simulation run, the number of tasks which are predecessors to each planned task are tabulated. Those tasks having no predecessors are used to initialize the task eligibility queues at the beginning of each lattice. High priority tasks are placed on the high priority queue (FIFO) in the defined order, and low priority tasks are placed on the low priority queue. When any task complete execution, a test is made of each of its successors in the defined order. Any successor task whose predecessors have all completed execution is added to the queue corresponding to the successor task priority.

Popup tasks are scanned for eligibility in the defined order.

In order to explain the various case lattices, we refer to the representative New York lattice of 1986 in Table 3.2.4-1. This lattice can be modified by deletions or substitutions to obtain any other lattice case.

The following general remarks can be made:

- Many of the task names are identical except for a final numerical digit. This number distinguishes the several available similar copies of a task that may be individually assigned to different processors. These copies may execute simultaneously or not; but all must complete before their successors become eligible or the lattice can complete (see below for an exception).
- All lattices define seven PAUS tasks (PAUS1 to PAUS7) and three SCTME tasks (SCTME1 to SCTME3). However, the number of copies actually active in the scheduler simulation for each is limited to no more than the number of system processors. The remaining copies are inhibited and do not execute.
- The number of copies of certain track related tasks corresponds in each lattice to the number of system sensors (4 in NY, 2 in Chicago

TABLE 3.2.4-1 LATTICE STRUCTURE FOR NEW YORK 1986

TASK/PRIORITY		-----SUCCESSORS-----				
TEXEC	H	TINIT1	TROUT1	TINIT3	TROUT3	TINIT2
		TROUT2	TINIT4	TROUT4	CA1	CA2
		CA3	CA4	TPSEC1	TCRSS1	TEDC1
		TPRED1	TPUR1	ALTRK1	MSAW1	SWABS1
		TPSEC2	TCRSS2	TEDC2	TPRED2	TPUR2
		ALTRK2	MSAW2	SWABS2	TPSEC3	TCRSS3
		TEDC3	TPRED3	TPUR3	ALTRK3	MSAW3
		SWABS3	TPSEC4	TCRSS4	TEDC4	TPRED4
		TPUR4	ALTRK4	MSAW4	SWABS4	
TUD	H	CRIT	IF0	AUT	SLINK	TPRED1
		TPUR1	SWABS1	TPRED2	TPUR2	SWABS2
		TPRED3	TPUR3	SWABS3	TPRED4	TPUR4
		SWABS4				
TUDS	H	TINIT1	TROUT1	TINIT3	TROUT3	TINIT2
		TROUT2	TINIT4	TROUT4	CA1	CA2
		CA3	CA4	TPSEC1	TCRSS1	TEDC1
		TPRED1	TPUR1	ALTRK1	MSAW1	SWABS1
		TPSEC2	TCRSS2	TEDC2	TPRED2	TPUR2
		ALTRK2	MSAW2	SWABS2	TPSEC3	TCRSS3
		TEDC3	TPRED3	TPUR3	ALTRK3	MSAW3
		SWABS3	TPSEC4	TCRSS4	TEDC4	TPRED4
		TPUR4	ALTRK4	MSAW4	SWABS4	
TUDX	H	CA1	CA2	CA3	CA4	
RKIP	H	RDOF				
RDOF	H					
DOP	L					
CDR	L					
PDOP	L					
CRIT	H					
IF0	H	TINIT1	TROUT1	TINIT3	TROUT3	TINIT2
		TROUT2	TINIT4	TROUT4		
		IF1				

TABLE 3.2.4-1 (Cont'd.)

TINIT1	H	MAT				
TINIT2	H	MAT				
TINIT3	H	MAT				
TINIT4	H	MAT				
TROUT1	H	PAUS1 PAUS6	PAUS2 PAUS7	PAUS3 SCTME1	PAUS4 SCTME2	PAUS5 SCTME3
TROUT2	H	PAUS1 PAUS6	PAUS2 PAUS7	PAUS3 SCTME1	PAUS4 SCTME2	PAUS5 SCTME3
TROUT3	H	PAUS1 PAUS6	PAUS2 PAUS7	PAUS3 SCTME1	PAUS4 SCTME2	PAUS5 SCTME3
TROUT4	H	PAUS1 PAUS6	PAUS2 PAUS7	PAUS3 SCTME1	PAUS4 SCTME2	PAUS5 SCTME3
MAT	H	MTP				
MTP	H	KOFA				
KOFA	H	IFI				
IFI	H	TDOP1 TDOP3	TDOP4	RTDOP	TDOP2	TDOP5
TDOP1	H	PAUS1 PAUS6	PAUS2 PAUS7	PAUS3 SCTME1	PAUS4 SCTME2	PAUS5 SCTME3
TDOP2	H	PAUS1 PAUS6	PAUS2 PAUS7	PAUS3 SCTME1	PAUS4 SCTME2	PAUS5 SCTME3
TDOP3	H	PAUS1 PAUS6	PAUS2 PAUS7	PAUS3 SCTME1	PAUS4 SCTME2	PAUS5 SCTME3
TDOP4	H	PAUS1 PAUS6	PAUS2 PAUS7	PAUS3 SCTME1	PAUS4 SCTME2	PAUS5 SCTME3
TDOP5	H	PAUS1 PAUS6	PAUS2 PAUS7	PAUS3 SCTME1	PAUS4 SCTME2	PAUS5 SCTME3

TABLE 3.2.4-1 (Cont'd.)

RTDOP	H	PAUS1	PAUS2	PAUS3	PAUS4	PAUS5
		PAUS6	PAUS7	SOTME1	SOTME2	SOTME3
CA1	L	CATR1	CATU			
CATR1	H					
CA2	L	CATR2	CATU			
CATR2	H					
CA3	L	CATR3	CATU			
CATR3	H					
CA4	L	CATR4	CATU			
CATR4	H					
TPRED1	L					
SWABS1	L					
TPUR1	L					
PUTT1	H	PUTT1				
TPRED2	L					
SWABS2	L					
TPUR2	L	PUTT2				
PUTT2	H					
TPRED3	L					
SWABS3	L					
TPUR3	L	PUTT3				
PUTT3	H					
TPRED4	L					
SWABS4	L					
TPUR4	L	PUTT4				

TABLE 3.2.4-1 (Cont'd.)

FUTT4	H
TCRSS1	L
TEDC1	L
TPSEC1	L
MSAW1	L
ALTRK1	L
TCRSS2	L
TEDC2	L
TPSEC2	L
MSAW2	L
ALTRK2	L
TCRSS3	L
TEDC3	L
TPSEC3	L
MSAW3	L
ALTRK3	L
TCRSS4	L
TEDC4	L
TPSEC4	L
MSAW4	L
ALTRK4	L
AUT	L
SLINK	L
CATU	H
PAUS1	L
PAUS2	L
PAUS3	L
PAUS4	L
PAUS5	L
PAUS6	L
PAUS7	L
SCIME1	L
SCIME2	L
SCIME3	L
CDT	POP
CTIP	POP
EDIC	POP
IFIP	POP
KIP	POP
PSRAF	POP
RIP	POP
MSPOP	POP

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STERLING SYSTEMS INC WASHINGTON DC

F/G 17/7

ASSESSMENT OF THE CAPACITY OF THE AUTOMATED RADAR TERMINAL SYST--ETC(U)

JUN 80 W PAILEN, H C WINTERMOYER, R SITTLER

DOT-FA78WAI-942

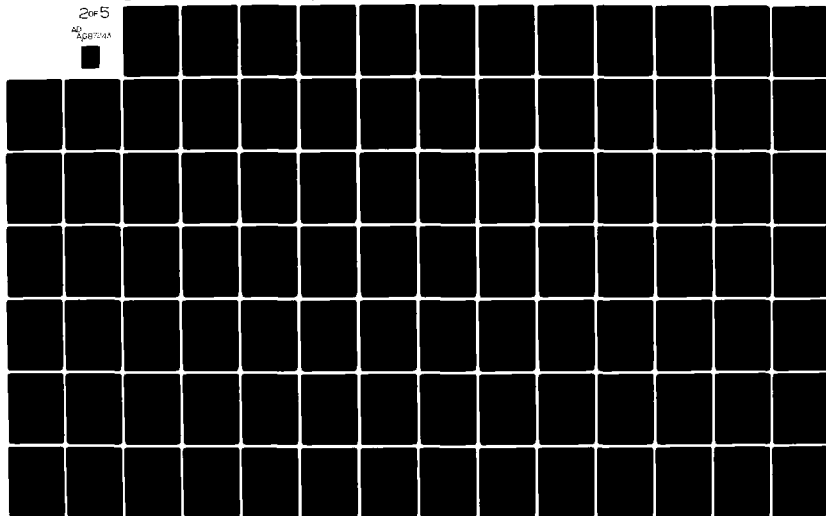
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and Los Angeles and 1 in Detroit). These tasks are:

TCRSS-	TPRED-	CA-
TEDC-	TPUR-	CATRK-
TPSEC-	SWABS-	PUTT-
MSAW-	TINIT-	DINIT-
ALTRK-	TROUT-	DABC-

The execution of such copies is assumed to occur with data from the corresponding sensor.

- The number of TDOP- copies for each site corresponds roughly to the size of the display requirements (number of displays).
- Conflict alert system capability is introduced by adding TUDX, CA-, CATRK- and CATU tasks. TUDX is an X-thread update, CA- are the copies of conflict screening and detection, CATRK- are the corresponding copies of a special track algorithm for conflict alert and CATU is a short cleanup task. In order to force CATRK- and CATU to complete before PAUS, it is necessary to set them to high priority. TUDX and CA- are low priority.
- The metering and spacing task, MSPOP, is a popup. There is no planned metering and spacing task. Originally, it was planned to split this task into a planned and popup task on a 50-50 basis. However, it became evident that the task was so demanding of time, that any substantial allocation as a planned task would cause lattice timeouts. As it is, the MSPOP task runs nearly continuously in one or another processor for the more demanding cases. Since the popup executions can continue across lattice boundaries, this does not disrupt the lattice.
- In order to integrate DABS with ARTS, the TINIT- tasks are replaced by DINIT-, TEDC- is replaced by DABC- and the following tasks are deleted: TPUR-, TCRSS-, TPSEC-, PUTT-.
- The implementation of a full digital ARTS display requires the introduction of RTDOP, RKIP and RDOP tasks where they are not already

provided (as in NY). Further, PUTT- tasks are defined as successors to the corresponding TPUR- tasks in order to process untracked targets. PUTT- tasks are given high priority to force completion before PAUS.

When DABS integration is introduced, PUTT- is deleted.

- The introduction of the advanced system enhancements above, as well as the ARTS/TIPS interface, affects the timing models for individual tasks, Section 3.2.2, but has no effect on the lattice definition beyond those mentioned above.

Starting with NY 1986 as a base, the other lattices may be obtained as follows:

New York:

1980 and Validation	Delete CA-, CATRK-, CATU, TUDX, PUTT-, MSPOP
1982	Delete PUTT-, MSPOP
1984	Delete MSPOP
1986	---
1988 and 1990	Delete TPUR-, PUTT-, TCRSS-, TPSEC- Change TINIT- to DINIT- TEDC- to DABC-

Chicago:

Two copies of all track related tasks.
Three copies of TDOP-.

1980	Delete CA-, CATRK-, CATU, TUDX, PUTT-, MSPOP, RTDOP, RKIP, RDOP
1982	Delete PUTT-, MSPOP, RTDOP, RKIP, RDOP
1984	Delete MSPOP
1986 to 1990	Delete TPUR-, PUTT-, TCRSS-, TPSEC- Change TINIT- to DINIT- TEDC- to DABC-

Los Angeles:

Two copies of all track related tasks.

Two copies of TDOP-.

(The changes for each year are the same as
for Chicago).

Detroit:

One copy of all track related tasks.

One copy of TDOP-.

(The changes for each year are the same as
for Chicago).

3.3 MEMORY REQUIREMENTS ANALYSIS

All program and data base modules for the ARTS IIIA system are stored on-line in fixed memory space. There is no use of dynamic memory allocation or program overlays.

As a result, storage utilization estimation for each year of the study is accomplished through simple summation of space required for all programs and tables, and addition of an amount to account for memory mapping loss.

The sources of information for space requirements for existing programs and data bases are ATC 25000 and information provided by UNIVAC describing changes to program and data base sizes as reflected in the New York System Design Data, Revision A which was developed in the fall of 1979.

Storage estimates for New York, Los Angeles, Chicago and Detroit are shown in Table 3.3-1 and 3.3-2. The estimates in Table 3.3-1 are based on level C traffic estimates, while those in Table 3.3-2 are based on level B traffic.

The storage requirements for each terminal area in the year 1980 are estimated by separately calculating the requirements for programs and data base.

For New York, the program storage requirements are taken directly from existing program sizes provided by UNIVAC (Table 3.3-3). Program storage estimates for Los Angeles, Chicago and Detroit are based on the sizes of programs existing at New York, modified to reflect some differences between the New York program and programs which may be installed elsewhere.

Data base estimates for 1980 for all sites are based on the formulas provided in ATC 25000 as modified by UNIVAC. These formulas, and the amounts of storage space allocated for each data base in the existing New York system are shown in Table 3.3-4.

As a convenience, and to simplify the computation of storage estimates, the data base estimated has been divided into two parts: variable data base storage and fixed data base storage. The variable portion of the data base includes all

TABLE 3.3-1 LEVEL C STORAGE ESTIMATES

	YEAR	BASIC PROGRAM	BASIC DATA BASE	CA	TIPS	FDAD	MBS	DABS	TOTAL	MM
NY	1980	85,640	135,242	81,141	24,113	24,299			220,882	14
	1982	85,640	139,931	84,865	24,533	24,544			306,712	19
	1984	85,640	144,772	87,695	24,533	24,544	63,440		363,689	23
	1986	85,640	151,292	90,160	24,893	24,772	66,020	5,000	437,144	27
	1988	85,640	150,154	92,158	25,181	24,940	67,740	5,000	446,639	28
LA	1980	80,920	67,806	32,299	14,405	13,993			148,726	10
	1982	80,920	68,975	33,106	14,573	14,091			182,194	12
	1984	82,690	73,430	33,799	14,741	14,225	49,680	5,000	217,624	14
	1986	82,690	72,030	34,460	14,885	14,309	51,840	5,000	271,863	17
	1988	82,690	74,812	35,050			53,980	5,000	277,758	17
CHI	1980	80,920	66,225	25,028	12,461	12,904			147,145	9
	1982	80,920	67,525	25,887	12,665	13,023			173,473	11
	1984	82,690	72,626	26,595	12,773	13,086	50,110	5,000	206,568	13
	1986	82,690	71,448	26,975	12,893	13,156	49,680	5,000	261,531	16
	1988	82,690	71,775	27,400			50,540	5,000	261,979	16
DET	1980	80,620	49,530	20,962	11,201	9,906			130,150	8
	1982	80,620	50,466	21,769	11,393	10,018			152,048	10
	1984	83,070	56,557	22,368	11,573	10,141	44,950	5,000	182,503	12
	1986	83,070	56,617	22,939	11,645	10,183	46,240	5,000	233,416	15
	1988	83,070	58,380	23,170			47,960	5,000	237,343	15
	1988	83,070	58,789						239,817	15
	1990	83,070								

TABLE 3.3-2 LEVEL B STORAGE ESTIMATES

	YEAR	BASIC PROGRAM	BASIC DATA BASE	CA	TIPS	FDAD	M&S	DABS	TOTAL	MM
NY	1980	85,648	118,982	44,646	17,501	20,442			204,630	13
	1982	85,648	120,557	46,769	17,825	20,631			250,851	16
	1984	85,648	127,420	48,353	17,825	20,631	63,440		297,780	19
	1986	85,648	128,973	49,785	18,113	20,817	66,020	5,000	364,870	23
	1988	85,648	127,749	51,119	18,377	20,971	67,740	5,000	373,132	23
LA	1990	85,648	128,661						377,516	24
	1980	80,920	58,553	22,067	11,501	12,299			139,473	9
	1982	80,920	58,996	22,709	11,621	12,369			161,983	10
	1984	82,690	63,902	23,092	11,765	12,489	49,680	5,000	193,101	12
	1986	82,690	62,405	23,558	11,897	12,566	51,830	5,000	246,857	16
CHI	1988	82,690	65,109	23,989			53,980	5,000	252,441	16
	1990	82,690	65,717						255,839	16
	1980	80,920	57,541	16,870	9,677	11,280			138,461	9
	1982	80,920	58,292	17,377	9,833	11,371			156,082	10
	1984	82,690	63,789	17,797	9,929	11,427	50,110	5,000	184,813	12
DET	1986	82,690	62,214	18,059	10,025	11,483	49,680	5,000	239,015	15
	1988	82,690	62,503	18,323			50,540	5,000	239,288	15
	1990	82,690	62,853						240,914	15
	1980	80,620	41,516	14,401	8,681	8,436			122,136	8
	1982	80,620	42,064	14,855	8,825	8,520			137,085	9
	1984	83,070	48,296	15,203	8,945	8,608	44,950	5,000	163,338	10
	1986	83,070	47,944	15,497	9,017	8,650	46,240	5,000	213,512	14
	1988	83,070	49,521	15,675			47,960	5,000	216,881	14
	1990	83,070	49,921						219,293	14

TABLE 3.3-3 PROGRAM STORAGE (NEW YORK, 1979)

PROGRAM	STORAGE
Executive	18,500
SRAP Processing	1,300
Keyboard Input Processing	1,800
Keyboard Op. Functions Processing	9,200
Interfacility Interrupt Processing	600
Interfacility Input Processing	3,000
Interfacility Output Processing	500
Tracking Executive	300
Tracking Cross Referencing	500
Tracking P/S Correlation	1,800
Tracking I/T Correlation	3,000
Tracking Process Unused Reports	1,500
Tracking Prediction	600
Altitude Tracking	500
Thread Update	700
MSAM Processing	1,000
Track Output	400
Periodic Display Output Processing	800
Tabular Display Output Processing	800
Display Output Control Processing	900
Automatic Offset	600
Bulk Store FP Processing	1,100
Sensor Switching (SWABS)	500
Quick Look Processing	250
Critical Data Processing	700
Monitor Tab. Coast and FPs Processing	250

TABLE 3.3-3 PROGRAM STORAGE (NEW YORK, 1979) (Cont'd.)

PROGRAM	STORAGE
CDR Extractor Control Processing	1,000
CDR Extractor Processing	1,500
Console TTY Input Processing	600
Tracking Early Discrete Correlation	700
Debug Aids	1,000
Intersubsystem Link Processing	300
RDBM Keyboard Input Processing	850
RDBM Display Output Processing	1,600
PAUS	250
Scratch Pad Time Monitor Processing	100
Reserved (NDRO, I/O, etc.)	2,048
On-Call Task Area	8,300
Common Subroutines	10,600
Memory Bank Mapping Loss	4,200
Miscellaneous	1,500
Total Program Storage	<u>85,648</u>

TABLE 3.3-4 DATA BASE STORAGE (NEW YORK, 1979)

TABLE NAME	FULL CAPABILITY
Central Track Store ($35T + KB_2 + 12T, KB_2 = 0.125$)	43,800
MDBM Buffers ($1700 * MDBM$)	17,000
RDBM Buffers ($660 * RDBM$) + 900	4,860
Track Record Table [$374(DISPL) + 2(374)(SNSR)$]	20,196
TTY Messages ($950 + 18 * SNSR + 8 * DISPL$)	1,390
Processor Biased Temporary Store ($300 * PROC$)	2,400
Keyboard Input Buffers ($100 * MDBM$)	1,000
Display Tables ($26 * DISPL$)	1,196
Keyboard Tables ($39 * KB$)	3,549
Selected Code Table	128
Airport Fix Table	126
Configuration Tables	1,200
SRAP Input Buffers ($192 * SNSR$)	768
Misc. SRAP Tables ($110 * SNSR$)	440
Track Index Table ($1 + KB_2$)T	1,350
Sector Access Store ($32 * SNSR$)	128
Sector Time Store ($32 * SNSR$)	128

TABLE 3.3-4 DATA BASE STORAGE (NEW YORK, 1979) (Cont'd.)

TABLE NAME	FULL CAPABILITY
Report Store (RPTS * 3)/2	1,800
Sector Summary Store (32 * SNSR)	128
Report Address Table	1,920
Radar Only Target Table	2,400
Beacon Only Target Table	744
Critical Data Buffer (11DISPL + 10KB + 11TA + 942)	11,158
Continuous Data Recording Data and Buffers	1,012
MSAW Data Base (214 + 1682 * SNSR)	6,942
TCID/ECID Index Tables and IF Data (1450 + 2 * TA)	3,050
IFR/VFR Code Table	58
Miscellaneous	<u>3,000</u>
Total Data Base Storage	131,871
+	
Total Program Storage	<u>85,648</u>
=	
Total Storage	217,519

storage whose estimated size depends upon the total number of tracks files, or the maximum number of associated tracks, target reports, MDBMs, RDBMs, displays, keyboards, or sensors in any user. It also includes the BOT, ROT and RAT Tables. By combining the formulas in Table 3.3-4, the size of the variable portion of the data base may be estimated by

$$37.625(T) + 1800(MDBM) + 660 \text{ RDBM} + 419(DISPL) + 2846 (SNSR) \\ + 300 (PROC) + 49(KB) + 1.5(RPTS) + 13(TA) + ROT + BOT + RAT$$

The fixed portion of the data base store includes those data base elements whose sizes do not vary. Examples are the selected code table, the airport fix table, and 900 words of the RDBM buffers.

Estimates of storage requirements for the basic data base (excluding enhancements) storage requirements for the years 1980 to 1990 are shown in Tables 3.3-5 through 3.3-8 for New York, Los Angeles, Chicago and Detroit. The system parameters which influence the size of the variable portion of the data base are also shown.

The parameter T includes associated and unassociated tracks obtained from good weather track estimates in Appendices G, H, I and J, and also includes estimates of the number of flight plans. The number of flight plans is estimated to be the same as the number of associated tracks, since flight plans and associated tracks are estimated to be in the system approximately the same amount of time (15 to 20 minutes).

The New York program contains one copy of each program module, except the following:

<u>Task</u>	<u>Copies</u>	<u>Total Storage</u>	<u>Storage Assumed for One Copy</u>
PAUS	3	250	80
TDOP	2	800	400
TINIT	2	3000	1500
TROUT	2	400	200

The programs at Chicago, Los Angeles and Detroit and assumed to require only one copy of each of the above tasks.

TABLE 3.3-5 BASIC* DATA BASE STORAGE ESTIMATES

NY

LEVEL C	T	MOBM	RDBM	DISPL	SNSR	PROC	KB	RPTS	TA	ROI	BOI	RAT	VARIABLE DATA BASE STORAGE	FIXED DATA BASE STORAGE	TOTAL DATA BASE STORAGE
1980	1643	10	6	46	4	8	91	1813	96	2400	276	1920	129,858	9980	139,838
1982	1693	10	6	46	4	8	91	1867	98	2400	300	1920	129,951	9980	139,931
1984	1744	10	11	50	4	9	95	1915	104	2400	306	1920	134,792	9980	144,772
1986	1783	10	11	50	4	10	95	1953	108	2400	324	1920	141,312	9980	151,292
1988	1817	11	11	52	4	9	98	1729	114	0	0	0	140,165	9980	150,154
1990	1841	11	11	52	4	9	98	1753	118	0	0	0	141,165	9980	151,145
LEVEL B	T	MOBM	RDBM	DISPL	SNSR	PROC	KB	RPTS	TA	ROI	BOI	RAT	VARIABLE DATA BASE STORAGE	FIXED DATA BASE STORAGE	TOTAL DATA BASE STORAGE
1980	1113	10	6	46	4	8	91	1267	96	2400	180	1920	109,002	9980	118,982
1982	1152	10	6	46	4	8	91	1309	98	2400	198	1920	110,577	9980	120,557
1984	1193	10	11	50	4	8	95	1348	104	2400	210	1920	117,440	9980	127,420
1986	1224	10	11	50	4	9	95	1367	108	2400	216	1920	118,993	9980	128,973
1988	1252	11	11	52	4	8	98	1164	114	0	0	0	117,769	9980	127,749
1990	1274	11	11	52	4	8	98	1186	118	0	0	0	118,681	9980	128,661

*The basic data base storage estimates include requirements for data storage for existing functions only.
The requirements for enhancements such as CA, M&S and TIPS are not included. However, storage requirements for the tracking tables ROI, BOI and RAT are eliminated when DAB is introduced.

The method of computation of the variable data base storage requirements is:

$$\text{Storage} = 37.625(T) + 1800(\text{MOBM}) + 660(\text{RDBM}) + 419(\text{DISPL}) + 2846(\text{SNSR}) + 300(\text{PROC}) + 49(\text{KB}) + 1.5(\text{RPTS}) + 13(\text{TA}) + \text{ROI} + \text{BOI} + \text{RAT}$$

TABLE 3.3-6 BASIC* DATA BASE STORAGE ESTIMATES

LA

LEVEL C	T	MDBM	RDBM	DISPL	SNSR	PROC	KB	RPTS	TA	ROT	BOT	RAT	VARIABLE DATA BASE STORAGE	FIXED DATA BASE STORAGE	TOTAL DATA BASE STORAGE
1980	872	4	0	14	2	3	29	846	65	1200	144	480	57,826	9980	67,806
1982	888	4	0	14	2	4	29	964	71	1200	156	480	58,995	9980	68,975
1984	910	4	4	16	2	4	31	981	73	1200	156	480	63,450	9980	73,430
1986	925	4	4	16	2	4	31	869	76	0	0	0	62,050	9980	72,030
1988	943	4	4	20	2	4	38	883	81	0	0	0	64,832	9980	74,812
1990	958	4	4	20	2	4	38	895	86	0	0	0	65,479	9980	75,459
LEVEL B	T	MDBM	RDBM	DISPL	SNSR	PROC	KB	RPTS	TA	ROT	BOT	RAT	VARIABLE DATA BASE STORAGE	FIXED DATA BASE STORAGE	TOTAL DATA BASE STORAGE
1980	633	4	0	14	2	3	29	700	65	1200	102	480	48,573	9980	58,553
1982	642	4	0	14	2	3	29	714	71	1200	108	480	49,016	9980	58,996
1984	668	4	4	16	2	4	31	731	73	1200	108	480	53,922	9980	63,902
1986	679	4	4	16	2	4	31	623	76	0	0	0	52,425	9980	62,405
1988	695	4	4	20	2	4	38	635	81	0	0	0	55,129	9980	65,109
1990	709	4	4	20	2	4	38	646	86	0	0	0	55,737	9980	65,717

*The basic data base storage estimates include requirements for data storage for existing functions only. The requirements for enhancements such as CA, M&S and TIPS are not included. However, storage requirements for the tracking tables ROT, BOT and RAT are eliminated when DARS is introduced.

The method of computation of the variable data base storage requirements is:

$$\text{Storage} = 37.625(T) + 1800(\text{MDBM}) + 660(\text{RDBM}) + 419(\text{DISPL}) + 2846(\text{SNSR}) + 300(\text{PROC}) + 49(\text{KB}) + 1.5(\text{RPTS}) + 13(\text{TA}) + \text{ROT} + \text{BOT} + \text{RAT}$$

TABLE 3.3-7 BASIC* DATA BASE STORAGE ESTIMATES

CHI

LEVEL C	T	MODM	RDBM	DISPL	SNSR	PROC	KB	RPTS	TA	ROT	BOT	RAT	VARIABLE DATA BASE STORAGE	FIXED DATA BASE STORAGE	TOTAL DATA BASE STORAGE
1980	702	5	0	20	2	3	40	767	74	1200	108	480	56,245	9980	66,225
1982	727	5	0	20	2	4	40	790	75	1200	120	480	57,545	9980	67,525
1984	749	5	5	22	2	4	42	815	74	1200	132	480	62,646	9980	72,626
1986	769	5	5	22	2	4	42	710	77	0	0	0	61,468	9980	71,448
1988	777	5	5	22	2	4	42	719	78	0	0	0	61,795	9980	71,775
1990	788	5	5	22	2	4	42	729	78	0	0	0	62,224	9980	72,204
LEVEL B	T	MODM	RDBM	DISPL	SNSR	PROC	KB	RPTS	TA	ROT	BOT	RAT	VARIABLE DATA BASE STORAGE	FIXED DATA BASE STORAGE	TOTAL DATA BASE STORAGE
1980	481	5	0	20	2	3	40	541	74	1200	78	480	47,561	9980	57,541
1982	500	5	0	20	2	3	40	556	75	1200	78	480	48,312	9980	58,292
1984	517	5	5	22	2	4	42	575	74	1200	84	480	53,809	9980	63,789
1986	533	5	5	22	2	4	42	474	77	0	0	0	52,234	9980	62,214
1988	540	5	5	22	2	4	42	482	78	0	0	0	52,523	9980	62,503
1990	549	5	5	22	2	4	42	490	78	0	0	0	52,873	9980	62,853

*The basic data base storage estimates include requirements for data storage for existing functions only. The requirements for enhancements such as CA, M&S and TIPS are not included. However, storage requirements for the tracking tables ROT, BOT and RAT are eliminated when DARS is introduced.

The method of computation of the variable data base storage requirements is:

$$\text{Storage} = 37,625(T) + 1800(\text{MODM}) + 660(\text{RDBM}) + 419(\text{DISPL}) + 2846(\text{SNSR}) + 300(\text{PROC}) + 49(\text{KB}) + 1.5(\text{RPTS}) + 13(\text{TA}) + \text{ROT} + \text{BOT} + \text{PAT}$$

TABLE 3.3-8 BASIC* DATA BASE STORAGE ESTIMATES

DET

LEVEL C	T	MDBM	RDBM	DISPL	SNSR	PROC	KB	RPTS	TA	ROT	BOT	RAT	VARIABLE DATA BASE STORAGE	FIXED DATA BASE STORAGE	TOTAL DATA BASE STORAGE
1980	590	3	0	11	1	3	23	608	57	600	96	120	39,550	9980	49,530
1982	612	3	0	11	1	3	23	633	62	600	102	120	40,486	9980	50,466
1984	635	3	5	15	1	3	27	656	63	600	108	120	46,577	9980	56,557
1986	652	3	5	15	1	4	27	604	65	0	0	0	46,637	9980	56,617
1988	670	3	5	17	1	4	31	613	68	0	0	0	48,400	9980	58,380
1990	679	3	5	17	1	4	31	625	72	0	0	0	48,809	9980	58,789
LEVEL B	T	MDBM	RDBM	DISPL	SNSR	PROC	KB	RPTS	TA	ROT	BOT	RAT	VARIABLE DATA BASE STORAGE	FIXED DATA BASE STORAGE	TOTAL DATA BASE STORAGE
1980	394	3	0	11	1	2	23	406	57	600	60	120	31,536	9980	41,516
1982	408	3	0	11	1	2	23	423	62	600	66	120	32,084	9980	42,064
1984	425	3	5	15	1	3	27	440	63	600	72	120	38,316	9980	48,296
1986	438	3	5	15	1	3	27	390	65	0	0	0	37,964	9980	47,944
1988	451	3	5	17	1	3	31	400	68	0	0	0	39,541	9980	49,521
1990	460	3	5	17	1	3	31	406	72	0	0	0	39,941	9980	49,921

*The basic data base storage estimates include requirements for data storage for existing functions only. The requirements for enhancements such as CA, M&S and TIPS are not included. However, storage requirements for the tracking tables ROT, BOT and RAT are eliminated when DABS is introduced.

The method of computation of the variable data base storage requirements is:

$$\text{Storage} = 37.625(T) + 1800(\text{MDBM}) + 660(\text{RDBM}) + 419(\text{DISPL}) + 2846(\text{SNSR}) + 300(\text{PROC}) + 49(\text{KB}) + 1.5(\text{RPTS}) + 13(\text{TA}) + \text{ROT} + \text{BOT} + \text{RAT}$$

The New York program also contains one copy of the following tasks:

<u>Task</u>	<u>Storage</u>
SLINK	300
RDOP + RTDOP	1600
RKIP	850

SLINK processes inter-sensor track links, and will be implemented only at multisensor sites. It is not expected to be installed at Detroit, which has a single sensor. RDOP, RKIP and RTDOP are assumed not to be implemented at Chicago, Los Angeles or Detroit until the installation of TCDD.

For years after 1980, the storage estimates include the impacts of functional enhancements.

New functions are assumed to be implemented on the following schedule

	<u>NY</u>	<u>OTHERS</u>
CA	1982	1982
TIPS	1983	1983
TCDD	1983	1983
FDAD	1984	1984
M&S	1985	1985
DABS	1988	1985

Storage requirement estimates for conflict Alert are shown in Tables 3.3-1 and 3.3-2. They are based on the following criteria established in reference [28]

Programs	5320
Tables	$1537 + 0.02T^2 + 13.6T$ (T = Total Track Capacity)
Total	$6857 + 0.02T^2 + 13.6T$

Storage increases for TIPS are estimated by UNIVAC as follows

KIP	45
SAD	600
Common Subroutine	400
IFI	2400
IFO	
IF Buffers, Data	700
KB & Display Data Base	$12(TA + TU)$
Total	$4145 + 12(TA + TU)$

TIPS storage estimates are shown in Tables 3.3-1 & 3.3-2.

The impact of the implementation of TCDDs is to require allocation of memory space for RDOP, RKIP and RTDOP at Chicago, Los Angeles and Detroit. No impact on program storage requirements is assumed at New York. Data base requirements will increase in proportion to the number of displays added. The amount of data base increase is reflected in the formula for this basic variable data base estimates.

The storage impact of FDAD is estimated by UNIVAC to be

$$3500 + 2200(\text{\#sensors}) + 7(TA + TU) + 9(\text{\#displays}).$$

(See paragraph 3.2.2.3.6 for a discussion of the impact of introducing FDADs). Tables 3.3-1 and 3.3-2 lists storage estimates for FDAD.

M&S storage estimates are shown in Tables 3.3-1 & 3.3-2 and are based on the following model (derived from Reference 18 and discussions with UNIVAC)

Programs	17000
Tables	10000 Words for 20 Tracks
Total	$17000 + 500(\text{M\&S Track Capacity})$ $= 17000 + 430(TA \text{ in Poor WX})$

This model assumes that M&S track capacity must be equal to the estimated number of associated tracks for arriving aircraft in a busy period. This number of tracks is estimated to be 86% of all associated tracks during poor weather. Associated track estimates in poor weather are shown in Table 3.3-9.

The memory requirements impact for ARTS/DABS integration is expected to be minor

TABLE 3.3-9
ESTIMATE OF ASSOCIATED TRACKS - POOR WEATHER

	NY	LA	CHI	DET
1980	96	65	74	57
1982	98	71	75	62
1984	104	73	74	63
1986	108	76	77	65
1988	114	81	76	68
1990	118	86	78	72

compared to the impact of CA, TIPS, FDAD and M&S. Some programs and tables will be deleted. They include

Programs

TPUR, TCRSS, TPSEC

Tables

BOT, ROT, RAT

Tables associated with TPUR

Tables associated with TPSEC (scoring parameters, etc.).

Overall, these programs and tables account for about 5000 words. This reduction is expected to be more than compensated for by increases in input buffer space, input processing logic and tracking tables. An increase in memory requirements of 5000 words is estimated for DABS.

3.4 PROCESSOR UTILIZATION MODEL VALIDATION

In order to verify the reasonableness of the processor utilization estimates, a comparison was made between simulated processing times and times measured during the processing of live data at New York. The live run used for comparison was run 2.

The lattice structure task models and hardware configuration used for the simulation were those assumed to be at New York in 1980. Traffic parameters used in the simulation consisted of a sample taken from the live run. These parameters are shown in Exhibits 3.4-1 through 3.4-4 .

The traffic sample consisted of tracks processed during one arbitrarily selected scan of the sensor in run 2. No attempt was made to determine how representative the data sample might be of conditions existing throughout the run. However, the duration of the run was short (less than one minute). It seems unlikely that a large change in the number of tracks in the system would occur in a one minute interval. However, there is a possibility that the average processing load during run 2 differed from that of the arbitrary sample.

The results of the comparison are shown in Tables 3.4-1 and 3.4-2. From these results, the following observations can be made:

- There is less than 10% difference in the average lattice times
- There is less than 10% difference in the proportion of time devoted to tasks.
- In general, the mean processing times for individual tasks are comparable to the measured times.

From these observations it may be concluded that the simulation results are reasonable.

EXHIBIT 3.4-1
TRAFFIC PARAMETERS USED FOR MODEL VALIDATION
SENSOR 1

SECTOR	TA	BU	ATH	UTH	CAT
1	0	6	0	1	0
2	0	6	0	0	0
3	0	8	0	2	0
4	0	5	0	0	0
5	0	5	0	1	0
6	2	4	2	1	0
7	1	8	0	2	0
8	0	11	0	1	0
9	1	8	0	1	0
10	0	1	0	0	0
11	0	3	0	1	0
12	0	1	0	1	0
13	0	1	0	0	0
14	0	2	0	0	0
15	0	0	0	0	0
16	0	2	0	1	0
17	0	0	0	0	0
18	0	0	0	0	0
19	0	1	0	0	0
20	0	1	0	1	0
21	0	4	0	3	0
22	1	12	0	5	0
23	0	7	0	2	0
24	0	7	0	2	0
25	0	11	0	3	0
26	1	9	1	2	0
27	0	6	0	1	0
28	0	9	0	4	0
29	0	7	0	4	0
30	1	11	0	4	0
31	1	14	0	6	0
32	0	7	0	1	0
101	8	172	3	50	0

EXHIBIT 3.4-2
TRAFFIC PARAMETERS USED FOR MODEL VALIDATION
SENSOR 2

SECTOR	TA	TU	ATU	UTU	COI
1	0	4	0	2	0
2	1	6	1	2	0
3	0	12	0	2	0
4	0	8	0	3	0
5	2	8	1	1	0
6	1	7	1	2	0
7	1	7	1	2	0
8	0	6	0	3	0
9	0	5	0	2	0
10	0	2	0	0	0
11	0	3	0	3	0
12	0	5	0	2	0
13	0	2	0	1	0
14	0	2	0	1	0
15	0	0	0	0	0
16	0	0	0	0	0
17	0	0	0	0	0
18	0	4	0	1	0
19	0	3	0	2	0
20	0	7	0	4	0
21	0	10	0	4	0
22	1	6	1	0	0
23	1	6	1	4	0
24	0	10	0	3	0
25	1	9	1	2	0
26	0	2	0	1	0
27	0	6	0	1	0
28	0	3	0	1	0
29	1	2	1	0	0
30	0	0	0	0	0
31	0	3	0	0	0
32	0	5	0	4	0
TOT	9	153	8	53	0

EXHIBIT 3.4-3
TRAFFIC PARAMETERS USED FOR MODEL VALIDATION
SENSOR 3

SECTOR	TA	TL	ATL	UTL	CAT
1	0	8	0	1	0
2	3	3	2	0	0
3	0	4	0	0	0
4	2	5	0	2	0
5	1	4	1	1	0
6	2	6	1	2	0
7	2	5	0	0	0
8	0	3	0	1	0
9	1	2	0	0	0
10	0	1	0	0	0
11	2	2	1	0	0
12	1	4	0	0	0
13	0	1	0	0	0
14	0	0	0	0	0
15	1	0	1	0	0
16	0	1	0	0	0
17	0	0	0	0	0
18	1	0	0	0	0
19	0	0	0	0	0
20	2	3	0	0	0
21	0	1	0	0	0
22	1	3	1	0	0
23	0	8	0	1	0
24	1	6	0	3	0
25	1	3	1	2	0
26	2	7	1	4	0
27	1	6	0	2	0
28	0	6	0	0	0
29	0	8	0	0	0
30	2	8	1	1	0
31	2	6	0	1	0
32	3	4	0	1	0
TOT	31	118	10	22	0

EXHIBIT 2.4-4
TRAFFIC PARAMETERS USED FOR MODEL VALIDATION
SENSOR 4

SECTION	TA	TD	ATD	UTD	CAT
1	0	1	0	0	0
2	0	2	0	1	0
3	0	5	0	4	0
4	0	7	0	1	0
5	0	0	0	0	0
6	0	1	0	0	0
7	0	0	0	0	0
8	0	0	0	0	0
9	0	2	0	7	0
10	0	3	0	0	0
11	0	2	0	0	0
12	0	3	0	0	0
13	0	1	0	1	0
14	0	1	0	0	0
15	0	0	0	0	0
16	0	0	0	0	0
17	0	0	0	0	0
18	0	4	0	1	0
19	0	2	0	0	0
20	0	3	0	2	0
21	0	5	0	1	0
22	0	9	0	7	0
23	0	5	0	1	0
24	0	6	0	3	0
25	0	5	0	1	0
26	0	3	0	0	0
27	0	2	0	1	0
28	0	2	0	1	0
29	0	4	0	1	0
30	0	2	0	1	0
31	0	4	0	2	0
32	0	3	0	2	0
TOT	0	82	0	33	0

TABLE 3.4-1
COMPARISON OF PERCENT PROCESSOR UTILIZATION - RUN 2 VS SIMULATION

	<u>Processor Utilization (%)</u>	
	<u>Run 2 (Live)</u>	<u>Simulation</u>
Planned tasks	64.6	67.2
Popup tasks	13.1	15.2
Overhead	11.6	10.1
Dead	1.9	0.8
Inactive	9.0	6.8

TABLE 3.4-2 COMPARISON OF MEAN LATTICE AND TASK TIMES - RUN 2 VS SIMULATION

		MEAN TIMES(MILS)	
		Run 2 (Live)	Simulation
LATTICE		87.3	80.3
Planned Tasks	ALTRK	2	2.7
	AUT	1	0.9
	CDR	1	1
	CRIT	1	1
	DOP	13	14
	IFI	1	5
	IFO	7	8.1
	KOFA	4	5.6
	MAT	1	1.3
	MSAW	1	1.7
	MTP	1	1
	PAUS	15.1	13.4
	PDOP	6	3
	RDOP	14	14.4
	RKIP	7	7.8
	RTDOP	2	3.6
	SCTME	1	0.4
	SLINK	1	8.2
	SWABS	1	1
	TCRSS	8	5.6
	TDOP	3	5.8
	TEDC	3	3.2
	TEEXEC	2	2
	TINIT	2.5	3.5
	TPRED	6	6.3
	TPSEC	7	6.9
	TPUR	14	7.4
	TROUT	2.5	3.0
	TUDS	9	7.9
	TUD	7	4.6
Popup Tasks	CDT	2	4.9
	CTIP	1	1.8
	EDISC	3	3
	IFI	1	0
	KIP	39	39.2
	PSRAP	20	20.7
	MSP	4	3.3

4.0 ANALYSIS RESULTS

4.1 Processing Capacity

For each of the four TRACONS, processor utilization estimates were obtained by simulation, using the ARTS IIIA scheduler simulation program with appropriate inputs to describe the site configuration, busy hour instantaneous traffic, lattice configuration, and task processing time equation. Simulations were conducted for New York, Chicago, Los Angeles and Detroit for the years 1980, 1982, 1984, 1986, 1988 and 1990. The initial number of processors assumed at each site in 1980 was:

<u>Tracon</u>	<u>Total IOPs</u>	<u>Redundant IOPs</u>	<u>Active IOPs</u>
New York	8	1	7
Chicago	3	0	3
Los Angeles	3	0	3
Detroit	1	0	1

Where the simulation results indicated that the capacity of the assumed number of active processors was exceeded for a given year, the number of processors was increased until there was adequate capacity or until a maximum of seven processors was used.

The most common indication of a capacity deficit was incomplete processing of the display task PAUS. The system scheduling logic is designed to cause PAUS processing to be curtailed in any lattice in which the lattice processing time exceeds a threshold. When this happens, the unprocessed PAUS data are held for processing during the next lattice. If a large number of lattices is unable to complete processing of PAUS, then some display data will never be output to the displays.

The scheduling logic designed to overcome this kind of difficulty is based on the theory that sector processing will lag behind the sensor antenna position in an overload condition. This logic causes target reports to be erased from memory for the next sector to be processed when sector processing lags the antenna position by five or more sectors. This is done to cause

the processing time for the next sector to be short, due to a lack of reports to be correlated. If sector processing lags by 10 or more sectors, no tracking tasks are processed for those sectors in excess of 10.

However, the simulation results indicate that the processing of sectors rarely falls behind the antenna position with anticipated loads. In only one case, (Detroit in 1980 with level C traffic and one active processor) did a lag appear. In this case, processing was nine sectors late at the end of one radar scan. When the number of processors was increased, and when level B traffic was assumed, processing did not lag.

In the usual overload case, processing of PAUS data is not completed, but sector processing remains synchronized with the antenna. This is interpreted to mean that track processing continues normally, but that some tracks may not be displayed in a heavy overload condition.

Simulation results for processor utilization at New York are summarized in Exhibit 4-1 for level C and level B traffic assumptions. Seven active processors were assumed for each year for both traffic levels. The results indicate that seven processors will be adequate until 1984 if level C traffic is assumed. Starting in 1984, one additional processor is required for all years except 1986. In 1986, the results indicated a need for two additional processors with level C traffic. When level B traffic is assumed at New York, seven processors appear to provide adequate capacity, except in 1986, when eight active processors are required.

Estimation of the number of additional processors required when a seven processor configuration is overloaded is accomplished by examination of the PAUS processing results. In Tables 4-1 through 4-5, estimates are derived for the total additional time per scan which would be required if all PAUS processing was completed. The estimates are:

EXHIBIT 4-1
PROCESSOR UTILIZATION SIMULATION RESULTS

NEW YORK

LEVEL C TRAFFIC

	1980	1982	1984	1986	1988	1990
Number of Processors	7	7	7	7	7	7
Lattices Executed	43	37	34	34	34	34
Lattice Duration: Mean	116.2 5.4	133.8 7.3	146.8 1.7	147.4 1.0	148.2 3.0	147.6 4.6
% Process Time: Planned						
Tasks	74.1	75.7	85.8	73.0	73.6	73.6
Popup						
Tasks	14.8	15.3	8.0	21.5	21.6	21.7
Overhd.	6.6	6.0	6.0	5.4	4.8	4.6
Dead	0.3	0.0	0.0	0.0	0.0	0.0
Inact.	4.2	3.0	0.2	0.0	0.0	0.0
Total Process Time for Tasks	30984	31535	32781	33145	35579	33477
Lattice Timeouts	0	3	33	34	33	33
Additional Process Time Required Per Scan*			1625	6341	2857	3258
Time Available Per Processor			4915	4915	4915	4915
Additional Processors Required	0	0	1	2	1	1
New Functions		CA	TIPS FDAD TCDD	M&S	DABS	

EXHIBIT 4-1
PROCESSOR UTILIZATION SIMULATION RESULTS (Cont'd.)

NEW YORK

LEVEL B TRAFFIC

	1980	1982	1984	1986	1988	1990
Number of Processors	7	7	7	7	7	7
Lattices Executed	54	47	42	34	41	40
Lattice Duration: Mean	91.9	105.6	119.6	145.4	121.7	125.6
σ	5.4	5.2	6.6	3.5	5.8	6.6
% Process Time: Planned						
Tasks	70.1	71.8	79.4	72.9	70.5	70.5
Popup						
Tasks	15.2	15.2	8.4	21.2	20.9	21.4
Overhd.	8.6	8.0	7.6	5.5	5.9	5.7
Dead	0.6	0.0	0.1	0.0	0.0	0.0
Inact.	5.5	4.9	4.5	0.5	2.7	2.4
Total Process Time for Tasks	20628	30226	30802	32563	31924	32319
Lattice Timeouts	0	0	0	29	0	0
Additional Process Time Required Per Scan*				344**		
Time Available Per Processor				4915		
Additional Processors Required	0	0	0	1**	0	0
New Functions		CA	TIPS FDAD TCDD	M&S	DABS	

* This represents the estimated minimum additional processing capacity required.
Capacity requirements may increase due to the use of additional processors.
**Processor capacity is marginally exceeded in simulation results for Level B
Traffic in 1986.

TABLE 4-1
ESTIMATE OF PROCESSING TIME REQUIREMENTS
IN EXCESS OF TIME AVAILABLE

NY 1984 LEVEL C TRAFFIC

<u>LATTICE</u>	<u>PAUS TIME REQUIRED</u>	<u>% PAUS COMPLETE</u>	<u>PAUS TIME COMPLETED</u>	<u>REMAINDER</u>
1				
2	413.1	99.7	411.1	2.0
3	420.4	65.3	274.5	145.9
4	424.0	80.2	340.0	84.0
5	423.4	84.2	356.5	66.9
6	424.7	91.9	390.3	34.4
7	425.2	91.7	389.9	35.3
8	422.4	81.8	345.5	76.9
9	423.2	92.9	393.2	30.0
10	430.3	95.4	410.5	19.8
11	422.0	85.5	360.8	61.2
12	425.4	97.9	416.5	8.9
13	428.2	97.1	415.8	12.4
14	426.3	90.8	387.1	39.2
15	423.0	81.5	344.7	78.3
16	430.0	87.5	376.3	53.7
17	426.6	93.8	400.2	26.4
18	425.7	99.8	424.8	0.9
19	420.4	70.1	294.7	125.7
20	422.7	81.9	346.2	76.5
21	423.6	94.0	398.2	25.4
22	430.0	61.6	264.9	165.1
23	424.4	98.3	417.2	7.2
24	420.4	91.6	385.1	35.3
25	426.4	94.1	401.2	25.2
26	425.6	95.5	406.4	19.2
27	442.0	88.8	392.5	49.5
28	426.2	86.0	366.5	59.7
29	426.1	75.9	323.4	102.7
30	423.9	98.2	416.3	7.6
31	424.2	88.8	376.7	47.5
32	426.3	97.9	417.3	9.0
33	426.0	80.3	342.1	83.9
34	427.0	97.7	417.2	9.8

1625.5 Total Time
for
Unprocessed
PAUS

TABLE 4-2
ESTIMATE OF PROCESSING TIME REQUIREMENTS
IN EXCESS OF TIME AVAILABLE

NY 1986 LEVEL C TRAFFIC

<u>LATTICE</u>	<u>PAUS TIME REQUIRED</u>	<u>% PAUS COMPLETE</u>	<u>PAUS TIME COMPLETED</u>	<u>REMAINDER</u>
1	311.0	79.8	248.2	62.8
2	433.1	56.6	245.1	188.0
3	434.3	46.6	202.4	231.9
4	437.2	59.1	258.4	178.8
5	438.2	51.0	248.8	188.4
6	432.9	54.0	233.8	199.1
7	436.6	60.1	262.4	174.2
8	438.5	57.4	251.7	186.8
9	435.3	75.3	327.8	107.5
10	435.5	46.3	201.6	233.9
11	436.2	52.3	228.1	208.1
12	441.9	45.0	198.9	243.0
13	432.8	72.8	315.1	117.7
14	434.1	44.1	191.4	242.7
15	435.1	62.6	272.4	162.7
16	437.8	51.0	223.3	214.5
17	433.0	45.9	198.7	234.3
18	436.6	51.1	223.1	213.5
19	441.8	60.5	267.3	174.5
20	441.6	84.2	371.8	69.8
21	437.9	47.4	207.6	230.3
22	434.1	61.5	267.0	167.1
23	435.3	61.4	267.3	168.0
24	438.5	62.9	275.8	162.7
25	441.2	59.7	263.4	177.8
26	439.6	75.7	332.8	106.8
27	439.5	55.7	244.8	194.7
28	435.3	44.7	194.6	240.7
29	438.0	49.4	216.4	221.6
30	434.0	34.8	151.0	283.0
31	435.3	57.9	252.0	183.3
32	438.8	63.5	278.6	160.2
33	435.3	63.0	274.2	161.1
34	432.9	41.8	181.0	251.9
				6341.4

TABLE 4-3
ESTIMATE OF PROCESSING TIME REQUIREMENTS
IN EXCESS OF TIME AVAILABLE

NY 1988 LEVEL C TRAFFIC

PAUS PROCESSING

<u>LATTICE</u>	<u>PAUS TIME REQUIRED</u>	<u>% PAUS COMPLETE</u>	<u>PAUS TIME COMPLETED</u>	<u>REMAINDER</u>
1				
2	418.0	98.5	411.7	6.3
3	451.6	82.9	374.4	77.2
4	460.2	72.9	335.5	124.7
5	461.4	88.9	410.2	51.2
6	463.8	79.4	368.3	95.5
7	457.3	69.4	317.4	139.9
8	464.2	74.1	344.0	120.2
9	457.3	89.8	410.7	46.6
10	462.7	85.0	393.3	69.4
11	462.9	90.1	417.1	45.8
12	465.6	79.4	369.7	95.9
13	465.0	86.3	401.3	63.7
14	470.1	86.1	404.8	65.3
15	460.1	84.5	388.8	71.3
16	460.0	68.7	316.0	144.0
17	471.7	74.7	352.4	119.3
18	461.7	81.8	377.7	84.0
19	455.4	83.8	381.6	73.8
20	462.8	77.6	359.1	103.7
21	462.2	73.0	337.4	124.8
22	462.4	92.3	426.8	35.6
23	464.2	88.4	410.4	53.8
24	459.1	90.3	414.6	44.5
25	465.8	84.4	393.1	72.7
26	458.4	73.6	337.4	121.0
27	456.4	75.8	346.0	110.4
28	464.1	67.9	315.1	149.0
29	456.2	82.1	374.5	81.7
30	459.4	76.4	351.0	108.4
31	461.8	79.2	365.7	96.1
32	457.4	77.4	354.0	103.4
33	464.0	81.9	380.0	84.0
34	458.4	83.8	384.1	74.3
	1424.3			2857.5

TABLE 4-4
ESTIMATE OF PROCESSING TIME REQUIREMENTS
IN EXCESS OF TIME AVAILABLE

NY 1990 LEVEL C TRAFFIC

<u>LATTICE</u>	<u>PAUS TIME REQUIRED</u>	<u>% PAUS COMPLETE</u>	<u>PAUS TIME COMPLETED</u>	<u>REMAINDER</u>
1				
2	396.1	97.9	387.8	8.3
3	459.6	79.1	363.5	96.1
4	460.8	79.4	365.9	94.9
5	458.7	73.7	338.1	120.6
6	472.9	74.2	350.9	122.0
7	465.3	70.6	328.5	136.8
8	461.4	69.9	322.5	138.9
9	465.4	78.6	365.8	99.6
10	464.7	93.4	434.0	30.7
11	480.3	75.4	362.1	118.2
12	464.5	79.4	368.8	95.7
13	483.7	71.7	346.8	136.9
14	469.2	79.6	373.5	95.7
15	465.4	78.5	365.3	100.1
16	467.1	73.0	341.0	126.1
17	462.2	68.1	314.8	147.4
18	477.3	72.5	346.0	131.3
19	460.9	98.8	455.4	5.5
20	456.7	82.2	375.4	81.3
21	464.1	76.6	355.5	108.6
22	467.8	69.2	323.7	144.1
23	465.1	73.2	340.5	124.6
24	462.6	89.3	413.1	49.5
25	463.5	75.7	350.9	112.6
26	464.6	88.0	408.8	55.8
27	468.7	79.0	370.3	98.4
28	467.5	79.8	373.1	94.4
29	464.8	67.0	311.4	153.4
30	466.6	80.7	376.5	90.1
31	468.0	79.7	373.0	95.0
32	469.1	67.7	317.1	152.0
33	463.7	88.4	409.9	53.8
34	462.2	89.3	412.7	49.5
				3257.9

TABLE 4-5
ESTIMATE OF PROCESSING TIME REQUIREMENTS
IN EXCESS OF TIME AVAILABLE

NY 1986 LEVEL B TRAFFIC

<u>LATTICE</u>	<u>PAUS TIME REQUIRED</u>	<u>% PAUS COMPLETE</u>	<u>PAUS TIME COMPLETED</u>	<u>REMAINDER</u>	<u>SUB. CUM.</u>
1					
2					
3	278.4	96.5	268.7	9.7	
4					
5	296.1	90.1	266.8	29.3	
6	303.0	98.5	298.5	4.5	
7	296.1	99.2	293.7	2.4	
8	296.1	83.8	248.1	48.0	
9	301.2	99.4	299.4	1.8	
10	296.1	98.2	290.8	5.3	
11	296.1	92.8	274.8	21.3	
12	298.2	97.4	290.4	7.8	
					120.4
13					
14	295.8	98.2	290.5	5.3	
15	296.1	97.3	288.1	8.0	
16	296.2	82.1	243.2	53.0	
17	299.9	97.4	292.1	7.8	
18	299.6	96.8	290.0	9.6	
19	301.1	97.6	293.9	7.2	
20	298.9	98.1	293.2	5.7	
21	296.1	99.0	293.1	3.0	
22	296.1	99.0	293.1	3.0	
23	296.1	97.1	287.5	8.6	
					111.2
24					
25	288.6	95.8	276.5	12.1	
26	298.2	96.9	289.0	9.2	
27	306.2	99.4	304.4	1.8	
28	296.1	96.7	286.3	9.8	
29	302.7	88.1	266.7	36.0	
30	298.6	97.8	292.0	6.6	
31	296.1	97.2	287.8	8.3	
32	300.2	90.2	270.8	29.4	
33	303.8	98.4	298.9	4.9	
34	296.1	98.4	296.1	4.7	
					113.0

EXHIBIT 4-2

PROCESSOR UTILIZATION SIMULATION RESULTS

CHICAGO

LEVEL C TRAFFIC

No. of Processors		1980	1982	1984	1986	1988	1990
4	Lattices Executed		55	45	43	42	42
	Lattice Duration: Mean		90.9	109.3	115.6	118.9	117.6
	σ		8.4	7.8	8.3	8.8	8.4
	% Process Time: Plnd.						
	Tasks		72.4	80.5	67.9	68.1	68.7
	Popup						
	Tasks		15.2	8.7	24.8	24.7	24.3
	Overhd.		7.6	7.0	5.3	5.5	5.2
	Dead		0.0	0.0	0.0	0.0	0.0
	Inact.		4.7	3.8	2.0	1.7	1.7
	Total Process Time for Tasks		17517	17547	18424	18540	18381
	Lattice Timeouts		0	0	0	0	0
3	Lattices Executed	40	36				
	Lattice Duration: Mean	125.2	137.4				
	σ	10.0	10.2				
	% Process Time: Plnd.						
	Tasks	73.6	74.2				
	Popup						
	Tasks	19.7	19.3				
	Overhd.	5.5	6.1				
	Dead	0.0	0.0				
	Inact.	1.2	0.4				
	Total Process Time for Tasks	14013	13873				
	Lattice Timeouts	2	10				
	New Functions		CA	TIPS FOAD TCDD	M&S DABS		

EXHIBIT 4-2 (Cont'd.)

PROCESSOR UTILIZATION SIMULATION RESULTS (Cont'd.)

CHICAGO

LEVEL 8 TRAFFIC

No. of Processors		1980	1982	1984	1986	1988	1990
4	Lattices Executed				54	53	51
	Lattice Duration: Mean				92.0	93.9	96.8
	σ				7.2	7.4	7.6
	% Process Time: Plnd. Tasks				65.6	65.4	65.2
	Popup Tasks				24.4	24.5	25.3
	Overhd.				6.5	6.7	6.4
	Dead				0.0	0.0	0.0
	Inact.				3.5	3.4	3.1
	Total Process Time for Tasks				19874	19905	19739
	Lattice Timeouts				0	0	0
3	Lattices Executed	48	42	38	34		
	Lattice Duration: Mean	103.9	118.0	130.4	145.9		
	σ	10.7	9.0	8.1	7.2		
	% Process Time: Plnd. Tasks	70.9	71.4	79.8	61.9		
	Popup Tasks	19.3	19.6	11.4	32.8		
	Overhd.	7.0	6.6	6.8	5.3		
	Dead	0.0	0.0	0.0	0.0		
	Inact.	2.8	2.4	2.0	0.1		
	Total Process Time for Tasks	13497	13530	13561	14092		
	Lattice Timeouts	0	0	2	28		
New Functions			CA	TIPS FOAD TCDD	M&S DABS		

EXHIBIT 4-3

PROCESSOR UTILIZATION SIMULATION RESULTS

LOS ANGELES

LEVEL C TRAFFIC

No. of Processors		1980	1982	1984	1986	1988	1990
4	Lattice Executed		57	48	46	39	38
	Lattice Duration: Mean		87.2	103.7	107.0	127.3	132.2
	σ		7.4	9.5	7.8	10.0	10.2
	% Process Time: Plnd.						
	Tasks		74.2	30.3	58.3	58.9	58.4
	Popup						
	Tasks		12.4	8.4	23.5	25.1	25.8
	Overhd.		7.7	7.2	5.7	4.7	4.6
	Dead		0.0	0.0	0.0	0.0	0.0
	Inact.		5.7	4.1	2.6	1.3	1.2
	Total Process Time for Tasks		17216	17659	18075	18665	18922
	Lattice Timeouts		0	0	0	0	0
3	Lattice Executed	42	37				
	Lattice Duration: Mean	119.5	135.5				
	σ	13.6	9.1				
	% Process Time: Plnd.						
	Tasks	75.7	76.1				
	Popup						
	Tasks	16.6	16.8				
	Overhd.	5.6	6.0				
	Dead	0.0	0.0				
	Inact.	2.1	2.1				
	Total Process Time for Tasks	13099	13970				
	Lattice Timeouts	0	7				
New Functions			CA	TIPS FDAD TCDD	M&S DABS		

EXHIBIT 4-3 (Cont'd.)

PROCESSOR UTILIZATION SIMULATION RESULTS (Cont'd.)

LOS ANGELES

LEVEL 8 TRAFFIC

No. of Processors		1980	1982	1984	1986	1988	1990
4	Lattice Executed			56	55	49	48
	Lattice Duration: Mean			88.3	90.3	101.2	104.0
	σ			7.8	8.1	7.8	8.4
	% Process Time: Plnd.						
	Tasks			77.6	66.3	66.1	66.0
	Popup						
	Tasks			7.9	23.3	25.3	25.7
	Overhd.			8.5	6.8	5.9	5.9
	Dead			0.0	0.0	0.1	0.0
	Inact.			5.9	3.6	2.7	2.5
	Total Process Time for Tasks			19017	17792	18133	18311
	Lattice Timeouts			0	0	0	0
3	Lattice Executed	49	43	36			
	Lattice Duration: Mean	103.3	115.9	136.7			
	σ	9.4	9.1	9.3			
	% Process Time: Plnd.						
	Tasks	73.9	74.1	80.8			
	Popup						
	Tasks	16.9	16.7	11.6			
	Overhd.	6.9	6.8	6.1			
	Dead	0.0	0.0	0.0			
	Inact.	2.3	2.4	1.5			
	Total Process Time for Tasks	13527	13522	13638			
	Lattice Timeouts	0	0	10			
	New Functions		CA	TIPS FDAD TCDD		M&S DABS	

EXHIBIT 4-4
PROCESSOR UTILIZATION SIMULATION RESULTS

DETROIT

LEVEL C TRAFFIC

No. of Processors		1980	1982	1984	1986	1988	1990
4	Lattices Executed				63	57	55
	Lattice Duration: Mean				78.3	87.0	89.6
	σ				6.1	7.0	8.6
	% Process Time: Plnd.						
	Tasks				69.4	70.8	70.0
	Popup						
	Tasks				19.7	19.7	20.9
	Overhd.				6.3	5.7	5.3
	Dead				0.7	0.6	0.8
	Inact.				3.9	3.2	3.1
	Total Process Time for Tasks				17572	17943	17913
	Lattice Timeouts				0	0	0
3	Lattices Executed	78	69	44	36		
	Lattice Duration: Mean	63.6	71.2	113.7	138.9		
	σ	10.7	12.5	13.7	13.4		
	% Process Time: Plnd.						
	Tasks	71.6	73.6	84.0	70.3		
	Popup						
	Tasks	12.9	12.8	7.7	24.9		
	Overhd.	8.3	8.0	5.8	4.4		
	Dead	1.8	0.3	0.0	0.0		
	Inact.	5.4	5.2	2.4	0.4		
	Total Process Time for Tasks	12573	12743	13768	14282		
	Lattice Timeouts	0	0	0	21		
2	Lattices Executed	40					
	Lattice Duration: Mean	123.9					
	σ	18.0					
	% Process Time: Plnd.						
	Tasks	76.6					
	Popup						
	Tasks	17.5					
	Overhd.	5.5					
	Dead	0.0					
	Inact.	0.3					
	Total Process Time for Tasks	9325					
	Lattice Timeouts	7					
1	Lattices Executed	23*					
	Lattice Duration: Mean	213.3					
	σ	24.0					
	% Process Time: Plnd.						
	Tasks	60.0					
	Popup						
	Tasks	33.4					
	Overhd.	6.6					
	Dead	0.0					
	Inact.	0.0					
	Total Process Time for Tasks	4689					
	Lattice Timeouts	23					
New Functions			CA		TIPS FDAD TCDD	M&S DABS	

*Processing was 9 sectors behind real time at the end of one scan period.

EXHIBIT 4-4 (Cont'd.)

PROCESSOR UTILIZATION SIMULATION RESULTS

DETROIT

LEVEL B TRAFFIC

No. of Processors		1980	1982	1984	1986	1988	1990
4	Lattices Executed						
	Lattice Duration: Mean						
	σ						
	% Process Time: PInd.						
	Tasks						
	Popup						
	Tasks						
	Overhd.						
	Dead						
	Inact.						
	Total Process Time for Tasks						
	Lattice Timeouts						
3	Lattices Executed			60	51	45	44
	Lattice Duration: Mean			83.2	97.0	109.3	112.9
	σ			9.7	11.6	12.7	13.5
	% Process Time: PInd.						
	Tasks			79.8	65.9	66.3	65.0
	Popup						
	Tasks			7.6	25.3	26.9	28.1
	Overhd.			7.5	5.9	5.0	5.1
	Dead			0.2	0.5	0.2	0.4
	Inact.			4.9	2.4	1.6	1.3
	Total Process Time for Tasks			14093	13531	13757	13873
	Lattice Timeouts			0	0	0	0
2	Lattices Executed	56	48	35			
	Lattice Duration: Mean	88.6	104.1	144.5			
	σ	14.6	16.5	7.3			
	% Process Time: PInd.						
	Tasks	73.5	73.3	82.4			
	Popup						
	Tasks	17.5	18.2	11.7			
	Overhd.	7.1	7.0	5.9			
	Dead	0.0	0.0	0.0			
	Inact.	1.8	1.6	0.0			
	Total Process Time for Tasks	9026	9145	8506			
	Lattice Timeouts	0	0	29			
1	Lattices Executed	26					
	Lattice Duration: Mean	194.7					
	σ	20.8					
	% Process Time: PInd.						
	Tasks	57.3					
	Popup						
	Tasks	35.6					
	Overhd.	7.1					
	Dead	0.0					
	Inact.	0.0					
	Total Process Time for Tasks	4663					
	Lattice Timeouts	26					
New Functions		CA		TIPS		M&S	
				FDAD		DABS	
				TCDD			

	<u>Year</u>	<u>Additional Time</u>
Level C traffic	1984	1600 mils
	1986	6300
	1988	2900
	1990	3300
Level B traffic	1986	300

It should be noted that the actual increased amount of processing time consumed by additional processors should exceed the amount required for PAUS processing. The reason is that additional processors will require overhead processing time and may enable the execution of additional tasks in a free running lattice design.

However, comparing the additional processing time required for PAUS to 4915 mils, which is the time available for one processor for one scan, the following additional active processors are required for New York.

	<u>Year</u>	<u>Additional IOPs</u>
Level C traffic	1984	1
	1986	2
	1988	1
	1990	1
Level B traffic	1986	1

Exhibits 4-2 through 4-4 summarize the processor utilization results for Chicago, Los Angeles and Detroit. The results indicate that four active processors is the maximum number expected to be required at any of these tracons.

Estimates of the total number of active processors required for New York, Chicago, Los Angeles and Detroit are given in Table 4-6.

4.2 Storage Capacity

The analysis results indicate that the demand for storage will equal or exceed

TABLE 4-6
ESTIMATE OF THE NUMBER OF REQUIRED ACTIVE PROCESSORS

LEVEL C TRAFFIC

	NY	LA	CHI	DET
1980	7*	3*	3*	3
1982	7	4	4	3
1984	8	4	4	3
1986	9	4	4	4
1988	8	4	4	4
1990	8	4	4	4

LEVEL B TRAFFIC

	NY	LA	CHI	DET
1980	7*	3*	3*	2
1982	7*	3*	3*	2
1984	7*	4	3	3
1986	8	4	4	3
1988	7	4	4	3
1990	7	4	4	3

*These numbers represent the planned initial configurations at New York, Chicago and Los Angeles. No attempt was made to determine if fewer processors could be used in 1980. For Detroit the assumed initial configuration included one processor. Therefore, the estimated processing requirements for Detroit in 1980 represent the minimum requirements for Level B and Level C traffic assumptions.

system capacity at all high traffic density sites, except single sensor sites. Exhibits 4-5 through 4-8 are charts of the storage requirement estimates for New York, Chicago, Los Angeles and Detroit. They indicate memory capacity will be exceeded in the following years:

<u>Tracon</u>	<u>Year Marginally Exceeded</u>	<u>Year Firmly Exceeded</u>
New York		1982
Chicago	1986	
Los Angeles		1986
Detroit	14 to 15 memory modules estimated in 1986. Capacity not exceeded.	

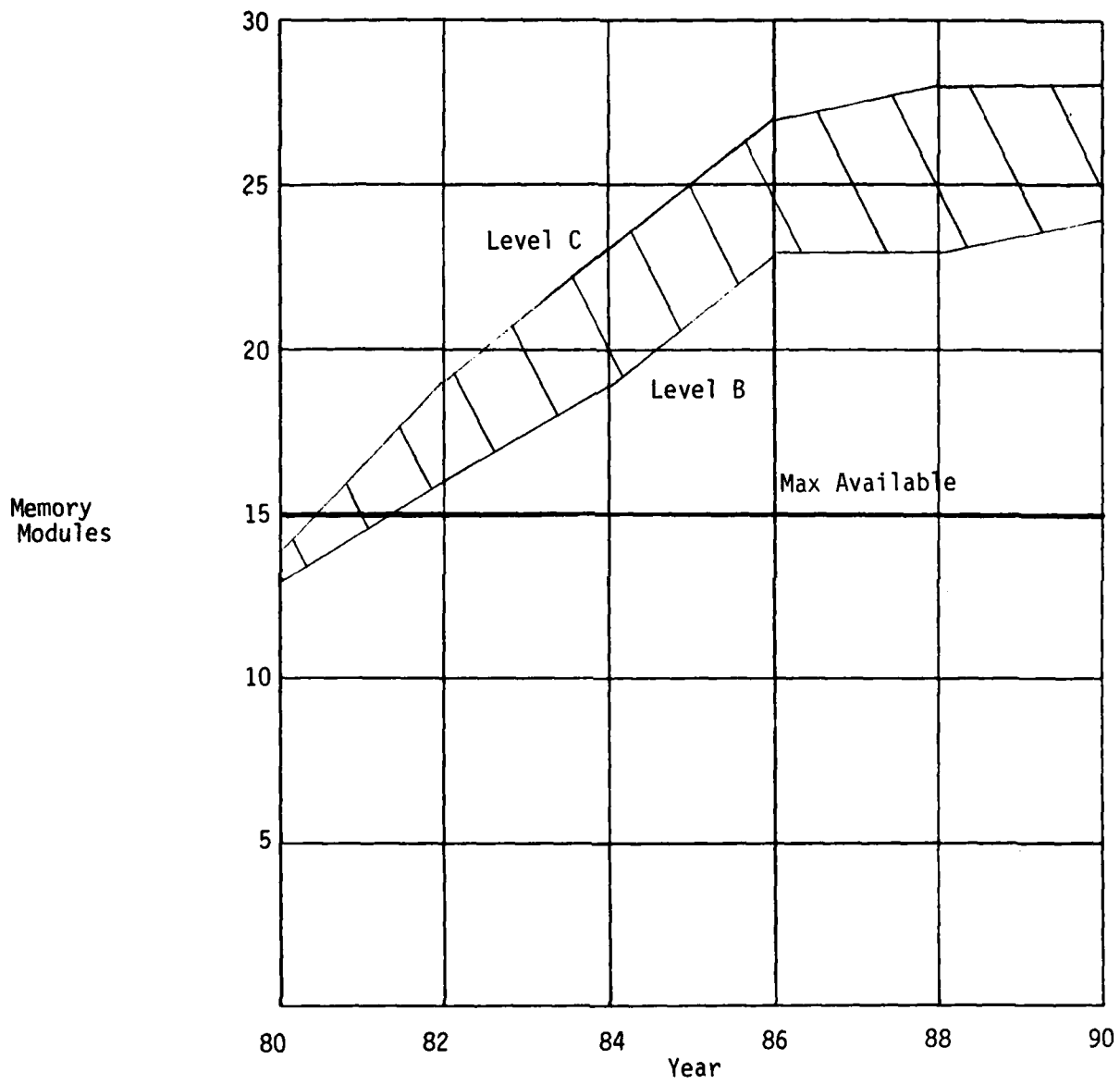


EXHIBIT 4-5
ESTIMATED NUMBER OF MEMORY MODULES - NEW YORK

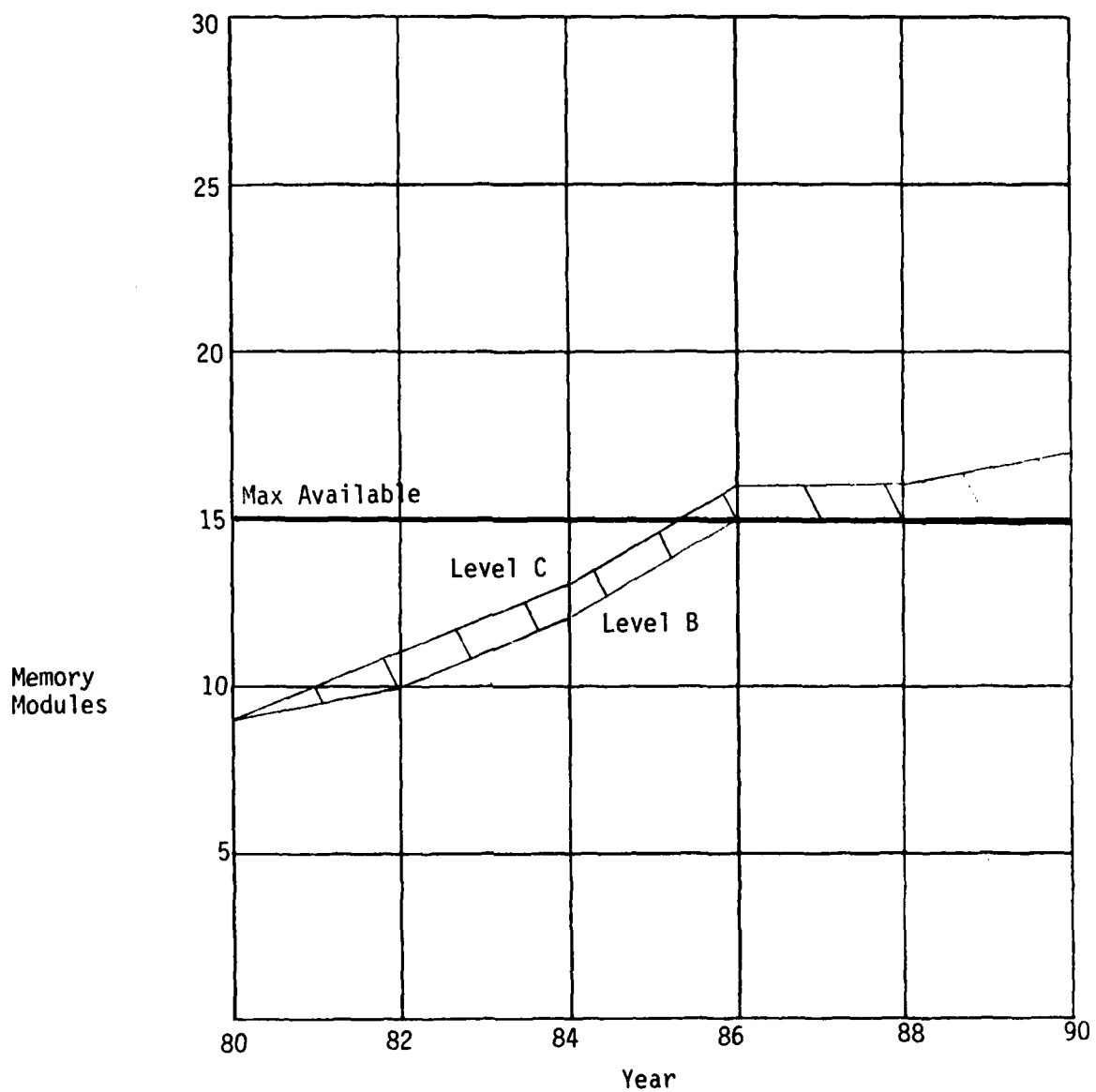


EXHIBIT 4-6
ESTIMATED NUMBER OF MEMORY MODULES - CHICAGO

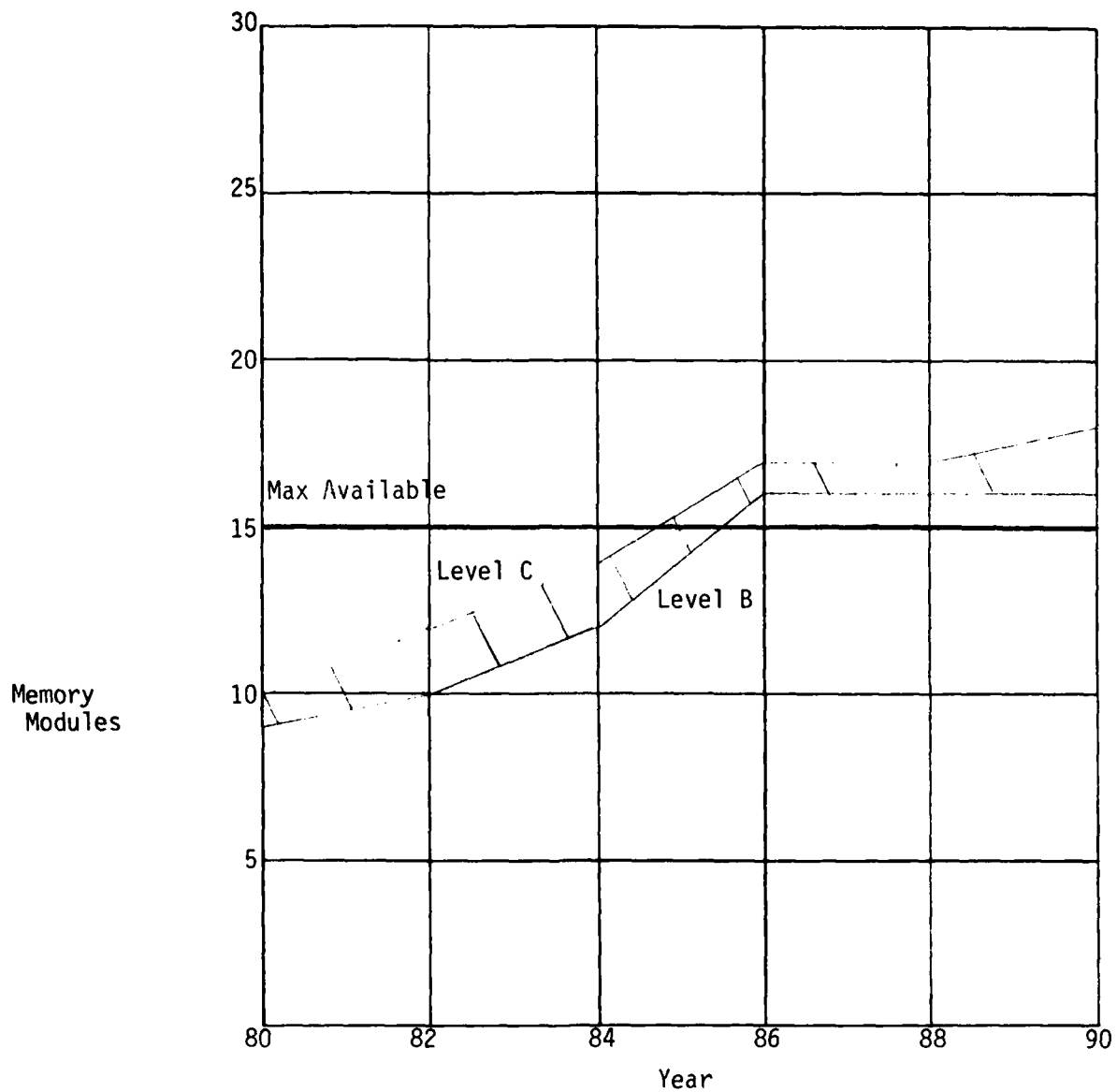


EXHIBIT 4-7
ESTIMATED NUMBER OF MEMORY MODULES - LOS ANGELES

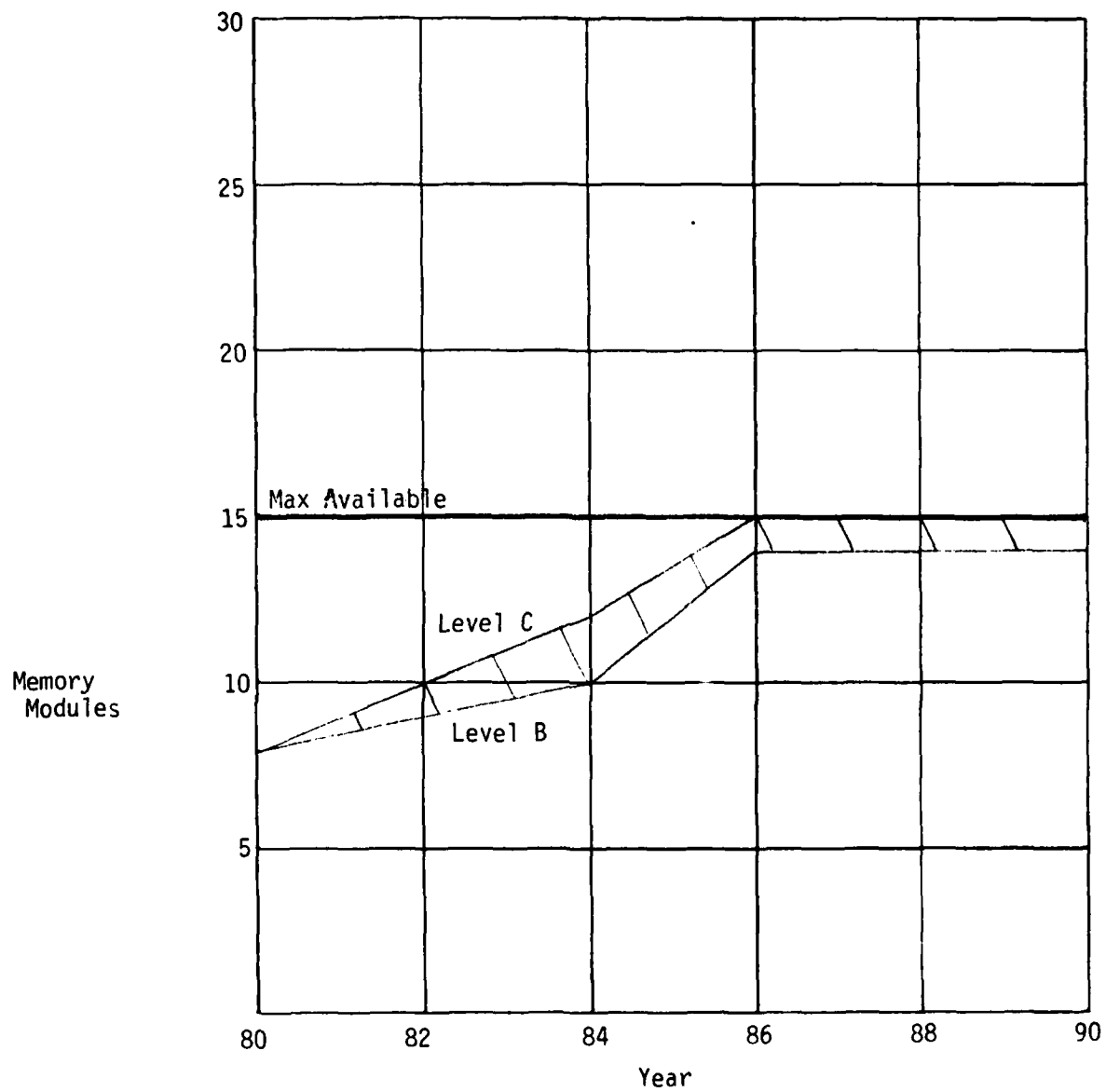


EXHIBIT 4-8
ESTIMATED NUMBER OF MEMORY MODULES - DETROIT

4.3 PROCESSING CAPACITY SENSITIVITY ANALYSIS RESULTS

The processing capacity requirements estimates resulting from the above analysis are based on the assumptions that

- The instantaneous traffic load during a busy hour will be within the range of the level B and level C estimates of this study
- CA, FDAD, M&S and DABS will be implemented within the time frame of the study
- The New York TRACON will automatically acquire tracks on radar and beacon targets

The sensitivity of the processing requirements to variations in traffic load from level B to level C may be seen by examination of Table 4-6.

- At New York in the years 1984 through 1990, the number of processors required for level C traffic is one greater than the number required for level B traffic.
- The number of processors required at Los Angeles and Chicago is sensitive to the traffic assumptions only in one year, 1982. In 1982, level C traffic estimates result in a requirement of four processors at Los Angeles and Chicago, while only three processors are required for level B traffic. However, four processors are required after 1982 regardless of whether the traffic is level C or level B.
- The variation in traffic estimates results in a variation of one processor at Detroit for all years except 1984. The number of processors at Detroit in 1984 is insensitive to the difference between level B and level C traffic.

Since the processing requirements at New York are expected to equal or exceed available capacity, an analysis was performed to determine the sensitivity of the capacity requirements to the implementation of future functional enhancements.

Future functions which are expected to have significant impacts on processing time are CA, FDAD, M&S and DABS. Exhibit 4-9 shows the estimated number of processors required for new functions in the years 1982 to 1990. The bases for the estimates are given in Exhibits 4-10 through 4-13.

The New York TRACON processing and memory requirements estimates were based on the assumption that New York would be implemented as a track-all system. If the New York system does not automatically acquire tracks on radar only targets, the processing and memory requirements can be expected to decrease slightly. Estimates for the amount of processing capacity attributable to tracking all targets instead of only beacon equipped targets is shown in Exhibit 4-14 (Level C traffic is assumed). The reduction in memory requirements would be approximately $37.625(R)$, where R is the number of radar only targets. For 1980, Level C traffic, the reduction in memory requirements would then be $37.625(451) = 16,969$ words, or about 1 MM.

EXHIBIT 4-9 ESTIMATED NUMBER OF PROCESSORS REQUIRED FOR NEW FUNCTIONS

LEVEL C, NEW YORK

	<u>CA</u>	<u>FDAD</u>	<u>M&S</u>	<u>DABS</u>
1982	0.30			
1984	0.31	0.86		
1986	0.34	0.87	0.93	
1988	0.37	0.91	0.94	-0.37
1990	0.40	0.92	0.94	-0.37

EXHIBIT 4-10 ESTIMATE OF PROCESSING REQUIREMENT IMPACT DUE TO CONFLICT ALERT
LEVEL C, NEW YORK

YEAR	Mean Time in Mils						#PROCESSORS**
	T _{TUDX}	T _{CA}	T _{CATRK}	T _{CATU}	T _{CONFLICT ALERT*}	T _{LATTICE}	
1982	7.9	20.7	10.0	2.0	40.6	133.8	0.30
1984	7.9	24.6	10.7	2.0	45.2	146.8	0.31
1986	7.9	28.4	11.9	2.0	50.2	147.4	0.34
1988	7.9	31.8	13.0	2.0	54.7	148.2	0.37
1990	7.9	35.0	13.7	2.0	58.6	147.6	0.40

* Computed by summing processing times for TUDX, CA, CATRK and CATU

**Total mean time for Conflict Alert tasks divided mean lattice time

EXHIBIT 4-11 ESTIMATE OF PROCESSING REQUIREMENT IMPACT DUE TO FDAD

LEVEL C, NEW YORK

YEAR	Mean Time in Mils				#PROCESSORS**
	T _{PUTT}	T _{PAUS}	T _{FDAD*}	T _{LATTICE}	
1982					
1984	4	421.6	125.9	146.8	0.86
1986	4	432.2	127.7	147.4	0.87
1988	4	456.1	135.3	148.2	0.91
1990	4	459.7	136.5	147.6	0.92

* Computed by summing the contributions due to PUTT and the increase in PAUS caused by FDAD. The total time for PAUS is

$$T_{PAUS} = 45.7 + 0.625\Sigma \quad (\Sigma \text{ is a function of the number of tracks and displays})$$

Without FDAD, the time for PAUS would be

$$T'_{PAUS} = 45.7 + 0.425\Sigma$$

The impact due to FDAD is, therefore

$$T_{PAUS} - T'_{PAUS} = 0.2\Sigma$$

Since

$$\Sigma = (T_{PAUS} - 45.7)/0.625$$

It follows that

$$T_{PAUS} - T'_{PAUS} = 0.32(T_{PAUS} - 45.7)$$

And

$$T_{FDAD} = 0.32(T_{PAUS} - 45.7) + T_{PUTT}$$

**Mean process time attributable to FDAD divided by mean lattice time

EXHIBIT 4-12 ESTIMATE OF PROCESSING REQUIREMENT IMPACT DUE TO M&S

LEVEL C, NEW YORK

	MS	$\Sigma(TA)$		LATTICES		$T_{M\&S}^*$ (Mils)	T_{SCAN}^{**} (Mils)	#PROCESSORS***
	Mean Time (Mils)	#Executions Per Scan		Mean Time (Mils)	#Executions Per Scan			
1982								
1984								
1986	142.9	32	84	147.4	34	4645.4	5011.6	0.93
1988	149.7	31	88	148.2	34	4714.6	5038.8	0.94
1990	149.7	31	88	147.6	34	4714.6	5018.4	0.94

* Expected processing time per scan due to M&S, computed by summation of the time for execution of the MS popup task and the increase in PAUS processing time for display of M&S data:

Time for MS task = (Mean time for MS) x (#Executions per scan)

Increased time for PAUS = $0.84 \Sigma(TA)$

**Total time for one scan = (Mean lattice time) x (#Lattices per scan)

*** $T_{M\&S}$ divided by T_{SCAN}

EXHIBIT 4-13 ESTIMATE OF PROCESSING REQUIREMENT IMPACT DUE TO DABS

LEVEL C, NEW YORK

	$\Sigma(TA)$	$\Sigma(TU)$	$\Sigma(TA)(TU)$	$\Sigma(ATD)$	$\Sigma(UTD)$	T_{DABS*} (Mils)	T_{SCAN} (Mils)	#PROCESSORS
1988	88	1641	1213	78	241	-1849	5038.8	-0.37
1990	88	1665	1207	82	257	-1856	5018.4	-0.37

* Computed by taking the time for DABS minus the time saved by removing TEDC, TPUR, TCRSS and TPSEC

Processing time for DABC: $2.55 + 0.83(TA + TU) + 0.3(TA)(TU)$

Processing time decrease for: TEDC $- (1.7 + 0.55(ATD + UTD) + 0.2(TA)(TU))$

TPUR $- 11.9$

TCRSS $- (3.7 + TU)$

TPSEC $- (7.8 + 0.5(TU))$

Total time change per lattice: $0.83(TA) - 0.67(TU) + 0.1(TA)(TU) - 0.55(ATD + UTD) - 22.6$

* Total time change per scan $0.83 \Sigma(TA) - 0.67 \Sigma(TU) + 0.1 \Sigma(TA)(TU) - 0.55 \Sigma(ATD + UTD) - 22.6L$

where

Σ is the sum over all lattices in a scan

L is the number of lattices in a scan

L = 34 for New York in 1988 and 1990

EXHIBIT 4-14

CHANGE IN ESTIMATED NUMBER OF PROCESSORS IN 1980 DUE TO AUTOMATED
INITIATION OF TRACKS ONLY ON BEACON EQUIPPED AIRCRAFT

LEVEL C, NEW YORK

TA	ATB	TU	UTB	ATD	L	UTD	$\Sigma(TA)(TU)^*$	$\Delta T_{1980}(\text{Mils})$	#PROCESSORS
76	70	1491	1033	58	43	189	1213	4500	0.27

*Estimated sum of products of TA and TU, where the products are taken for each sector of each sensor.

$$T_{PAUS} = 0.0381(CTS)(\#Lattices) + 0.425 \sum_j \sum_k TU(j,k) \#Displays(j) \\ \sim .0381(CTS)(\#Lattices) + 4.9 \sum_j \sum_k (TU)$$

$$T_{TCRSS} = 3.7(\#Lattices)(\#Sensors) + \sum_j \sum_k \Sigma(TU)$$

$$T_{TEDC} = 1.7(\#Lattices)(\#Sensors) + 0.55 \sum_j \sum_k \Sigma(ATD + UTD) + 0.2 \sum_j \sum_k \Sigma(TA)(TU)$$

$$T_{TPRED} = 3.1(\#Lattices)(\#Sensors) + 1.3 \sum_j \sum_k \Sigma(TA + TU)$$

$$T_{TPSEC} = 7.8(\#Lattices)(\#Sensors) + 0.53 \sum_j \sum_k \Sigma(TU)$$

EXHIBIT 4-14

CHANGE IN ESTIMATED NUMBER OF PROCESSORS IN 1980 AND 1990 DUE TO AUTOMATED
INITIATION OF TRACKS ONLY ON BEACON EQUIPPED AIRCRAFT (cont'd)

LEVEL C, NEW YORK

$$\begin{aligned} T_{\text{Track all}} &= \left[0.0381(TA + TU) + 16.3(\#Sensors) \right] (\#Lattices) + 7.7 \sum_j \sum_k \Sigma(TU) \\ &\quad + 1.3 \sum_j \sum_k \Sigma(TA) + 0.2 \sum_j \sum_k \Sigma(TU) + 0.55 \sum_j \sum_k \Sigma(ATD + UTD) \\ T_{\text{Beacon only}} &= \left[0.0381(ATB + UTB) + 16.3(\#Sensors) \right] (\#Lattices) + 7.7 \sum_j \sum_k \Sigma(ATD + UTD) \\ &\quad + 1.3 \sum_j \sum_k \Sigma(ATB) + 0.2 \sum_j \sum_k \Sigma(ATB)(UTB) + 0.55 \sum_j \sum_k \Sigma(ATD + UTD) \end{aligned}$$

$$\begin{aligned} \Delta T_{1980} &= T_{\text{Track all}} - T_{\text{Beacon only}} \\ &\leq 0.0381(\Delta TA + \Delta TU)(\#Lattices) + 7.7(\Delta TU) + 1.3(\Delta TA) \\ &\quad + 0.2 \sum_j \sum_k \Sigma(TA)(TU) \end{aligned}$$

$$\text{where } \Delta TA = \sum_j \sum_k \Sigma(TA) - \sum_j \sum_k \Sigma(ATB)$$

$$\Delta TU = \sum_j \sum_k \Sigma(TU) - \sum_j \sum_k \Sigma(UTB)$$

j = sensor, k = sector

5.0 CONCLUSIONS

Resource requirement estimates for Chicago and Los Angeles are representative of requirements for dual sensor sites with high traffic densities. Requirements for Detroit are representative of single sensor sites with high traffic densities.

5.1 Processing Capacity

TRACONS with single sensor systems or dual sensor systems are expected to require a maximum of four active processors. This is well below the maximum ARTS IIIA configuration of seven active IOPs (assuming one spare processor).

The processing capacity required at New York during a busy period in 1986 is expected to be 8 to 9 active processors, exceeding the available capacity by 1 or 2 processors.

In the years 1984, 1988 and 1990, the processing capacity required at New York is expected to be 7 to 8 active processors, exceeding available capacity by 0 to 1 processor.

In 1980 and 1982 the processing capacity required at New York is expected to be 7 active processors.

5.2 Memory Capacity

Memory requirements are expected to exceed available memory capacity by 1982 at New York and by 1986 at high traffic density dual sensor sites. Available memory appears to be adequate for the requirements at single sensor sites through 1990. Use of standard ARTS IIIA programs at dual and single sensor sites, instead of the New York ARTS IIIA programs which have been optimized for processing efficiency, potentially will cause some reduction in memory requirements at these sites.

6.0 RECOMMENDATIONS

Normal development cycles for major air traffic control automation systems can be as long as seven to ten years. The problems of storage saturation at all major sites and processing capacity saturation at New York need to be addressed in much shorter time frames.

As a result, viable options for near term ARTS IIIA capacity increases should be examined. This approach is not necessarily an alternative to the development of a replacement system, but should be considered independently of plans for ARTS IIIA replacement.

In addition to development of approaches for increasing ARTS IIIA capacity, methods of minimizing demand for resources should be investigated. One potential means of reducing the peak demand for processor capacity at New York is to install DABS prior to the installation of M&S.

APPENDICES

APPENDIX A

PROCESSES AND ASSUMPTIONS APPLIED IN DERIVING IAC SYSTEM LOAD FACTORS

1 IAC (Good Weather Estimates)

1.1 Determination of Airports in the Vicinity of the Surveillance Sites

The determination of airports in the vicinity of the surveillance sites was accomplished in several steps. Sectional Aeronautical Charts were scrutinized to identify airports within, or close to within, a 60 mile radius of any of the surveillance sites of interest. The coordinates of these airports were then determined from the Airport/Facility Directory (or DOD Flight Information Publication Supplements for military airports). Having this data and the coordinates of the surveillance sites (obtained from the Controller Chart Supplement, Section 9, Air Route and Airport Surveillance Radar Facilities), the distance from the surveillance site to each of the pertinent airports was then computed and recorded.

For those airports within 60 miles of the radar sites, a search was made of the FAA's terminal area forecast data (Military Air Traffic Activity Report in the case of military airports) to determine if forecast (or activity) data were available. Where this was the case, the appropriate annual numbers for each operation and aviation category were extracted for the fiscal years 1977, 1980, 1982, 1984, 1986, 1988 and 1990. These, along with the identification of the airport and its distance from the pertinent surveillance site, were then input as part of the data base used for IAC estimation.

1.2 Estimation of Busy Hour Flights.

The objective of this step is to estimate the number of flights (in each of the operations and aviation categories) operating to/from each of the airports in the vicinity of the surveillance site during the course of a busy hour. These data are subsequently used in estimating the IAC during a period of high activity.

The average hour values can be determined quite simply by dividing the number of hours in a year into the annual value. However, estimation of the values during a period of high activity requires the use of busy/average hour ratios. For this purpose, busy/average hour relationships as a function of the total annual operations of an airport were developed from busy hour and annual activity data reported in FY69, FY72, FY73 and FY76 for airports where the control towers (source of the counts) were in operation 24 hours daily. This relationship, as depicted in Exhibit A-1 is represented by the equation

$$\text{Busy/Average Hour Ratio} = 8.72e^{-.0035x} + 1$$

where x = total annual operations (in thousands)

(Note: Derivation of the equation is described in Appendix B)

It is pertinent to note that the above equation relates to the busy/average hour relationship at an airport, not an area. Thus, if one were to use this ratio, per se, to estimate the number of flights in an area during a period of high activity, it would be tantamount to assuming that all of the airports in the area experience their busy hour at the same time. This seems most unlikely. On the other hand, if one were to use the average hour value for each airport to determine the number of operations in the area during a high activity period, it would be tantamount to assuming that for each operation above the average at one or more of the airports, there is a corresponding number of operations below the average at the remaining airports. While perhaps somewhat more plausible than assuming all the airports experience their busy hour at the same time, it is still considered quite unlikely that this would represent the situation during the area's busy hour. It is more reasonable to believe that the appropriate value lies somewhere in between, probably biased more toward the average than toward the busy/average hour ratio of the individual airports. Accordingly, three sets of values are derived as estimates of the hourly number of operations at the airports in the area which are subsequently used in estimating the IACs. The first is simply the average and is carried through the remaining IAC computations merely as an item of interest that may be

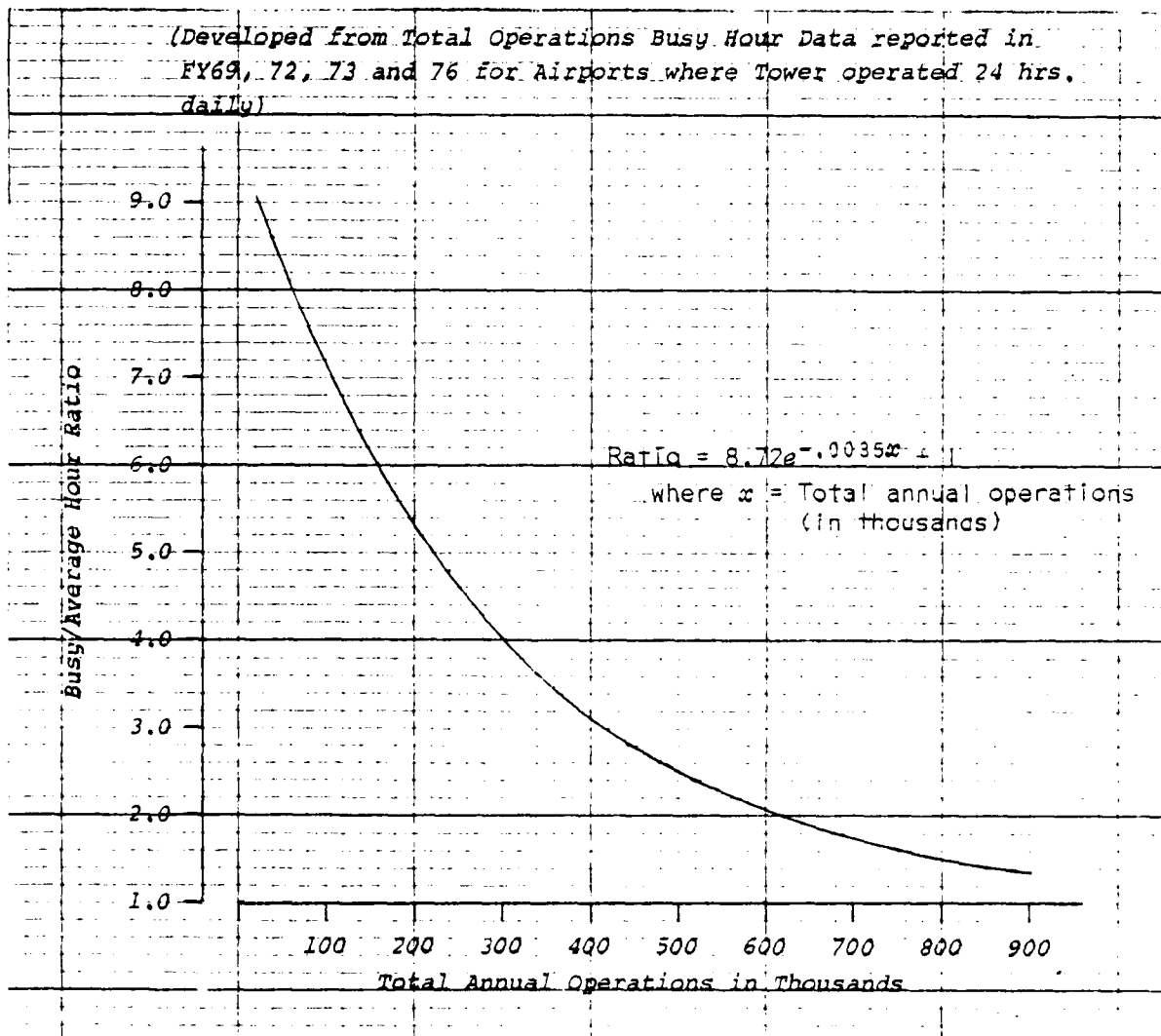


EXHIBIT A-1

Busy/Average Hour Relationship
as a Function of Total Annual Operations

used as a point of reference. It is not particularly germane to a determination of whether the system's capacity is adequate to handle expected future load conditions. The remaining two are used to represent a low and high range of estimates.

In line with the foregoing, the busy/average hour ratios applied in determining each airport's contribution to the area busy hour were:

$$A \text{ (Average Hour) } \text{Ratio} = 1$$

$$B \text{ (Busy Hour) } \text{Ratio} = .25(\text{Busy/Average Hr. Ratio}_a - 1) + 1$$

$$C \text{ (Busy Hour) } \text{Ratio} = .5(\text{Busy/Average Hr. Ratio}_a - 1) + 1$$

where a = Busy/Average Hr. Ratio for the airport.

The number of flights of each operations category (Itinerant and Local) and of each aviation category, i.e., AC (Air Carrier), AT (Air Taxi and Commuter), GA (General Aviation) and MA (Military Aircraft), are computed for each airport as described below using each of the ratios (A, B and C) previously described. The results represent the estimated number of flights in each category operating to/from that airport during the area's busy hour.

- Itinerant Flights: (Separate computations are made for AC, AT, GA and MA)

$$\frac{\text{Forecast Annual Itinerant Operations}}{8760} \cdot \text{Ratio}$$

(*3760 = Number of hours in a year)

- Local Flights: (Separate computations are made for GA and MA)

$$\frac{.5(\text{Forecast Annual Local Operations})}{8760} \cdot \text{Ratio}$$

(*Local operations include both the departure and arrival of flights whose departure and arrival are at the same airport; hence, local flights are only 50% of local operations.)

1.3 Estimation of IAC Base Values (Tentative).

The objective of this step is to convert the estimates of the number of flights operating to/from airports in the area during a busy hour to estimates of the number of flights simultaneously within the coverage area of the particular surveillance system. Fundamentally, this is a function of the time each flight spends in the coverage area which, in turn, is a function of the average speed and distance flown in the coverage area. Since these are unknown, it is necessary to estimate the required values for each aviation and operation category and, as relates to surveillance coverage, for each surveillance site.

The basic assumption is that all flights operating to/from an airport during the hour (with exception of part of the local flights discussed later), are uniformly distributed throughout the area surrounding the airport. The average speed and altitude for each aviation category are weighted averages resulting from general characteristics and performance assumptions presented in Appendix C. The radius of surveillance coverage is based on the detectability and shielding angle assumptions presented in Appendix D. The resulting values used in the computation are contained in Table A-1.

It should be noted that separate computations are required for the radar and beacon systems as well as for each operation and aviation category for each airport.

1.3.1 Itinerant Flights.

There are three different cases pertaining to the location of the airport with respect to the area of surveillance coverage that determine the specific computation used. These cases and the appropriate computations are as follow:

TABLE A-1

Estimated Speed, Altitude and Radius of Surveillance
Coverage by Operation and Aviation Category

	-----Itinerant-----				Gp. 1 Local			-----Itinerant-----				Gp. 1 Local			Gp. 2 Local	
	AC	AT	GA	MA	GA	MA		AC	AT	GA	MA	GA	MA			
Av. Speed	280	175	110	280	110	280		280	175	110	280	110	280		N/A	
Av. Altitude (x 100)	85	40	25	85	25	85		85	40	25	85	25	85		10	
TRACON Site	-----Itinerant-----				Gp. 1 Local			-----Itinerant-----				Gp. 1 Local			Gp. 2 Local	
	AC	AT	GA	MA	GA	MA		AC	AT	GA	MA	GA	MA			
Radius of Surveillance Coverage																
N90	JFK	Radar				Beacon				Radar & Beacon						
		60	50	37	60	37	60	60	50	37	60	37	60			
		60	40	28	60	28	60	60	40	28	60	28	60			
		60	44	31	60	31	60	60	44	31	60	31	60			
ORD	CHI-S	60	52	38	60	38	60	60	52	38	60	38	60			
		60	54	40	60	40	60	60	54	40	60	40	60			
		60	54	40	60	40	60	60	54	40	60	40	60			
		60	54	40	60	40	60	60	54	40	60	40	60			
LAX	LAX4	59	36	26	59	26	59	59	36	26	59	26	59			
		59	36	26	59	26	59	59	36	26	59	26	59			
DTW	DTW	60	57	51	60	51	60	60	60	58	60	58	60			
		60	57	51	60	51	60	60	60	58	60	58	60			

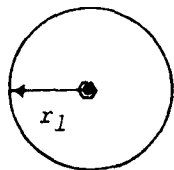
• Surveillance Site

r_1 = radius of surveillance coverage

○ Airport

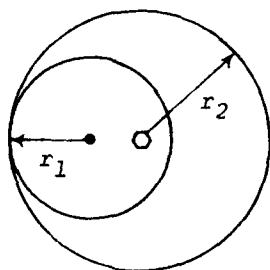
r_2 = r_1 + distance from surveillance site to airport.

Case 1: Surveillance site located on the airport.



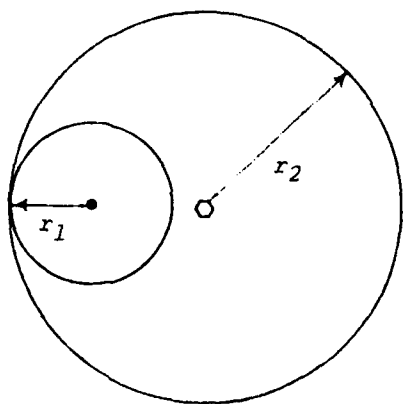
$$N = \frac{r_1 + 10}{\text{Av. Speed}} \cdot \text{Busy Hour Flights}$$

Case 2: Distance from surveillance site to airport $\leq r_1$.



$$N = \frac{r_2 + 10}{\text{Av. Speed}} \cdot \text{Busy Hour Flights} \cdot \frac{\pi r_1^2}{\pi r_2^2}$$

Case 3: Distance from surveillance site to airport $> r_1$.



$$N = \frac{r_2}{\text{Av. Speed}} \cdot \text{Busy Hour Flights} \cdot \frac{\pi r_1^2}{\pi r_2^2}$$

1.3.2 Local Flights

Local flights include two generally different groups of flight activity.

Group 1 is comprised of aircraft on sight-seeing flights or operating to, from or within local practice areas. Group 2 is comprised of aircraft remaining in close proximity to the airport (10 mile radius) and executing touch-and-go landings or full stop landings followed by taxi back and take-off.

It is assumed that 50% of the local flights, whether GA or MA, are in Group 1 and the remaining 50% are in Group 2. Separate computations are performed for the different aviation categories. Additionally, the method of computation differs according to Group.

Group 1:

For Group 1 (i.e., 50% of Busy Hour Local Flights), the computation is identical to the computation for itinerant flights except the results are multiplied by two. This is because the aircraft are assumed to be going both out from and back to the airport during the busy hour, while an itinerant flight travels in one direction only. As a result, Group 1 flights travel twice the distance that itinerant aircraft travel within radar coverage.

Group 2:

For Group 2 (i.e., the remaining 50% of Busy Hour Local Flights), speed is not a factor since the flights are assumed to be equally distributed within a circle having a 10 mile radius from the airport. It is further assumed that the flights in this group are airborne 75% of the busy hour and on the airport surface the remaining 25% and that, while airborne, their average altitude is 1,000 feet.

Obviously, if the 10 mile radius circle around the airport falls totally outside the radius of surveillance coverage for 1,000 feet, none of the aircraft in this group would be in the coverage area. Conversely, if the 10 mile radius circle around the airport falls totally within the radius of surveillance coverage at 1,000 feet, all of the airborne aircraft in this group are considered to be within the coverage area. Where the two circles partially overlap, the number of airborne aircraft in this group in the surveillance coverage area is proportionate to the area of the overlap region to the area of the 10 mile radius circle.

From the foregoing, it is evident that the ratio of the area of the overlap region to the area of the 10 mile radius circle around the airport (CR) is a function of two values, viz., the distance (d) from the surveillance site to the airport and the radius of surveillance coverage (ROSC) at the average altitude assumed for the flights. It may be recalled that the distance (d) was previously determined for each airport in the area and stored in the data base. The values of ROSC pertinent to this computation are given for each surveillance site under the column labelled Gp. 2 Local, Radar & Beacon, in Table A-1.

The computation for the Group 2 Local Flights is as follows:

$$N = .5(\text{Busy Hour Flights}) \cdot .75 \cdot CR$$

$$\text{For } d \leq (ROSC - 10), CR = 1$$

$$\text{For } d \geq (ROSC + 10), CR = 0$$

Where $(ROSC - 10) < d < (ROSC + 10)$, CR is determined as follows:

$$CR = \frac{1}{100\pi} \left[10^2 \left(\frac{\pi \angle B}{180} - \sin \angle B \cos \angle B \right) + ROSC^2 \left(\frac{\pi \angle A}{180} - \sin \angle A \cos \angle A \right) \right]$$

$$\text{where } \angle A = \arccos \left(\frac{d^2 + ROSC^2 - 10^2}{2 \cdot ROSC \cdot d} \right)$$

$$\text{and } \angle B = \arccos \left(\frac{d^2 + 10^2 - ROSC^2}{2 \cdot 10 \cdot d} \right)$$

(Note: Derivation of this equation is described in Appendix E)

1.3.3 Fluctuation in IAC During the Hour

After summing the individual airport values pertinent to a particular surveillance system, the end result of the processes described thus far is the estimated average number of aircraft in each aviation category that are instantaneously within the coverage of that system during a busy hour for each of the ratio values assumed (i.e., A, B and C). Since the number

would obviously fluctuate above and below the average during the course of the hour and the peak values are the ones of interest, a peaking factor of 1.2 (i.e. $1.2 \cdot \text{Average IAC during Busy Hour}$) is applied. The value of 1.2 was based on past observations of peak to average instantaneous tracks during busy hour operations at the New York CIFRR. The reasonableness of this value was further substantiated by average and peak beacon target report counts made for Chicago and Los Angeles in the fall of 1979 by ARD-143.

1.3.4 Distribution by Radar Only, Beacon Only and Radar Reinforced Beacon.

The purpose of this step is to break down the tentative IAC base values into categories relevant to processing requirements -- i.e., radar only, beacon only and radar reinforced beacon with the beacon categories further broken down as to discrete or non-discrete code and automatic altitude reporting (Mode C) capability. The term "base values" is used to denote the estimated number of targets in each category if the probability of detection were 100% and there were no false targets. The "tentative" qualification is applied since it is possible that some adjustments may be required when the IAC estimates are merged with the instantaneous associated track estimates to complete the system load factor estimates.

At this point in the process, the number of aircraft in each operation and aviation category has been summed for all the airports and the peaking factor has been applied. Converting this set of numbers into categories such as radar only, beacon only, etc., requires the application of assumptions regarding beacon equipment and code assignments as well as the consideration of any differences in the radius of surveillance coverage of the radar system as compared to the collocated beacon system.

The beacon assumptions made for the good weather conditions are reflected in Table A-2. The radius of surveillance coverage for each of the radar and co-located beacon sites for each of the operation and aviation categories is contained in Table A-1.

TABLE A-2
BEACON ASSUMPTIONS

(During Good Weather Conditions)

	FY-77	FY-80	FY-82	FY-84	FY-86	FY-88	FY-90
<u>AIR CARRIER</u>							
Beacon Equipped	100	100	100	100	100	100	100
Mode C	100	100	100	100	100	100	100
Discrete Code	100	100	100	100	100	100	100
<u>AIR TAXI & COMMUTER</u>							
Beacon Equipped	100	100	100	100	100	100	100
Mode C	95	97	98	99	100	100	100
Discrete Code	50	54	58	62	66	72	75
<u>MILITARY AIRCRAFT</u>							
Beacon Equipped	100	100	100	100	100	100	100
Mode C	95	97	98	99	100	100	100
Discrete Code							
Itinerant	60	65	70	75	80	85	90
Local	0	0	0	0	0	0	0
<u>GENERAL AVIATION</u>							
Beacon Equipped	65	68	71	73	75	78	80
Mode C	15	21	25	28	32	36	40
Discrete Code							
Itinerant	5	5	6	7	8	9	10
Local	0	0	0	0	0	0	0

Values in the table represent the percent of the total aircraft estimated to be within the beacon surveillance area.

Discrete Code is the estimated percent that will be responding with a discrete code, not the percent with discrete code capability .

The distribution is determined by applying the following computations to the numbers for each operations and aviation category (using the appropriate values from the beacon assumption table) and summing the results.

RIAC = Number in radar coverage area as determined from previous computations.

BIAC = Number in beacon coverage area as determined from previous computations.

Radar Only = RIAC(1 - Percent Beacon Equipped)

Beacon Only = Percent Beacon Equipped(BIAC - RIAC)

Discrete = Percent Discrete Code(BIAC - RIAC)

Non-Discrete = Beacon Only - Discrete

Mode C = Percent Mode C(BIAC - RIAC)

Radar Reinforced Beacon = Percent Beacon Equipped • RIAC

Discrete = Percent Discrete • RIAC

Non-Discrete = Radar Reinforced Beacon - Discrete

Mode C = Percent Mode C • RIAC

1.4 Estimation of Target Reports (Tentative).

Conversion of the IAC base values to estimates of the number of target reports in each of the radar only, beacon only, etc. categories is based on probability of detection and false target assumptions. The values assumed for this purpose are contained in Table A-3.

The "tentative" qualification also applies here since any change in the IAC base values that may occur in the system load factors finalization process requires recomputation of the target report estimates.

In application of the probability of detection (or conversely, the probability of missed detection) to the radar reinforced beacon base values,

TABLE A-3

PROBABILITY OF DETECTION AND FALSE TARGET ASSUMPTIONS

Radar

<i>Probability of Detection</i>	<i>.96</i>
<i>False Targets</i>	
<i>Good Wx Conditions</i>	<i>50/scan</i>
<i>Poor Wx Conditions</i>	<i>100/scan</i>

Beacon

<i>Probability of Detection</i>	<i>.96*</i>
<i>False Targets</i>	<i>.0417 x No. of targets detected **</i>

** Assumes 4% loss of targets due to antenna shielding in turns and multi-path cancellation effects.*

*** Number of false targets due to reflections, side-lobes, etc., is assumed to approximately equal number of missed detections.*

it is assumed that the radar and beacon misses do not occur at the same time for the same aircraft. Thus, for each assumed beacon miss of an aircraft initially in the radar reinforced beacon category, the number in that category is reduced by one but the number in the radar only category is increased by one. Similarly, for each assumed radar miss of an aircraft initially in the radar reinforced beacon category, that category is also reduced by one but the number in the beacon only category is increased by one.

The assumed number of radar false targets are added to the radar only category while the number of beacon false targets resulting from the beacon false target probability assumption are added to the beacon only category. The false target report values (radar and beacon) also constitute the estimated values for the "Unused Target Reports" category of the IAC System Load Factors.

While the above manipulations appear relatively straight forward, the process is somewhat complicated by the requirement to maintain a breakdown of the beacon counts into the discrete, non-discrete and Mode C sub-categories. The equations used in the process are set forth in Table A-4.

2 IAC (Poor Weather Estimates).

The methodology and computations used in deriving the IAC estimates for poor weather conditions are identical to those used in deriving the IAC (Good Weather Estimates). With several exceptions, the assumptions made are also identical. These exceptions are as follow:

- There are no Local Operations under these conditions.
- The number of GA Itinerant Operations is reduced to 40% of the good weather values. The number of AC, AT and MA Itinerant Operations are assumed to remain unaffected, i.e., remain the same as the good weather values.

TABLE A-4

ADJUSTMENT OF BASE VALUES TO ACCOUNT FOR
PROBABILITY OF DETECTION AND FALSE TARGETS

- Legend -

RO	= Radar Only
BO	= Beacon Only
RRB	= Radar Reinforced Beacon
Subscript "b"	= Base value (i.e., estimated number of targets if the probability of detection were 100% and there were no false targets)
Subscript "a"	= Adjusted value based on probability of detection and false target assumptions
Prefix "d"	= Discrete code
Prefix "n"	= Non discrete code
Prefix "c"	= Mode C
RPD	= Radar probability of detection (parameter; assumed value = .96)
BPD	= Beacon probability of detection (parameter; assumed value = .96)
BFTP	= Beacon false target probability (parameter; assumed value = .0417)
BFT	= Beacon false targets. $BFT = BFTP(BPD(RRB_b + BO_b))$
RFT	= Radar false targets (parameter; assumed value for "good" weather = 50; assumed value for "bad" weather = 100)

- Equations -

$$\begin{aligned}
 \text{Total Target Reports}_a &= RO_a + BO_a + RRB_a \\
 RO_a &= RPD \cdot RO_b + (RRB_b - RRB_b \cdot BPD) + RFT \\
 BO_a &= dBO_a + nBO_a \\
 dBO_a &= (1 + BFTP) \cdot ((dBO_b \cdot BPD) + (dRRB_b - dRRB_b \cdot RPD)) \\
 &\quad + BFTP(dRRB_b - dRRB_b((1 - RPD) + (1 - BPD))) \\
 nBO_a &= (1 + BFTP) \cdot ((nBO_b \cdot BPD) + (nRRB_b - nRRB_b \cdot RPD)) \\
 &\quad + BFTP(nRRB_b - nRRB_b((1 - RPD) + (1 - BPD))) \\
 cBO_a &= (1 - BFTP) \cdot ((cBO_b \cdot BPD) + (cRRB_b - cRRB_b \cdot RPD)) \\
 &\quad + BFTP(nRRB_b - nRRB_b((1 - RPD) + (1 - BPD)))
 \end{aligned}$$

TABLE A-4 (Cont'd.)

*Adjustment of Base Values to Account for Probability of Detection
and False Targets (Continued)*

$$\begin{aligned} RRB_a &= dRRB_a + nRRB_a \\ dRRB_a &= dRRB_b - dRRB_b((1 - RPD) + (1 - BPD)) \\ nRRB_a &= nRRB_b - nRRB_b((1 - RPD) + (1 - BPD)) \\ cRRB_a &= cRRB_b - cRRB_b((1 - RPD) + (1 - BPD)) \end{aligned}$$

- The number of radar false targets per scan is estimated to be 100 (instead of 50 as estimated in the good weather case).
- The assumptions regarding beacon equipment and code assignments differ from the good weather assumptions. The beacon assumptions applied in the poor weather estimates are presented in Table A-5.

3 Estimation of Instantaneous Associated Tracks.

3.1 Annual Activity Base Numbers.

The method of estimating the instantaneous number of associated tracks at an ARTS IIIA TRACON differs in a number of respects from that used in estimating the IAC counts. This is due, in part, to the nature of the problem and the nature of the annual forecast data available. In this regard, it is pertinent to remember that in the ARTS IIIA system, associated tracks are analogous to airborne aircraft receiving radar services from the TRACON (or any of its associated towers that are tied in to the system), whereas the IAC counts are estimates of the number of aircraft in the surveillance coverage area, not just those being handled by the facility. Consequently, it is more appropriate to use the forecasts of annual instrument operations for these estimates than to use total operations (Itinerant and Local) as was done for the IAC estimates. There are, however, several aspects of the annual instrument operations forecasts that make them unsuitable to serve as the annual base numbers without first applying certain interpretations and/or assumptions. The basic problems posed by the data available and the approach taken are outlined below.

Forecast instrument operations are presented in the annual forecast data base for each airport that had an FAA operated tower in service during the year preceding the year in which the forecast data base was established. They are presented whether or not the tower has approach control authority. These forecasts represent projections from the annual activity reported by the facilities during the previous year. Forecasts are not provided for airports

TABLE A-5

BEACON ASSUMPTIONS

(During Poor Weather Conditions)

	FY-77	FY-80	FY-82	FY-84	FY-86	FY-88	FY-90
<u>AIR CARRIER</u>							
Beacon Equipped	100	100	100	100	100	100	100
Mode C	100	100	100	100	100	100	100
Discrete Code	100	100	100	100	100	100	100
<u>AIR TAXI & COMMUTER</u>							
Beacon Equipped	100	100	100	100	100	100	100
Mode C	95	97	98	99	100	100	100
Discrete Code	85	87	88	89	90	90	90
<u>MILITARY AIRCRAFT</u>							
Beacon Equipped	100	100	100	100	100	100	100
Mode C	95	97	98	99	100	100	100
Discrete Code	95	97	98	99	100	100	100
<u>GENERAL AVIATION</u>							
Beacon Equipped	76	80	82	84	86	88	90
Mode C	25	31	35	38	42	46	50
Discrete Code	42	45	46	47	48	49	50

Values in the table represent the percent of the total aircraft estimated to be within the beacon surveillance area.

Discrete Code is the estimated percent that will be responding with a discrete code, not the percent with discrete code capability.

without control towers. As a consequence, an airport related approach is not feasible. Data are not available for each of the airports involved and, for the towered airports, double counting would result from flights counted by the towers not having approach control authority as well as the one that does. Accordingly, the approach taken uses the total annual instrument operations forecast for the terminal facility having approach control jurisdiction for the area. For New York, because of the impending changeover from the New York CIFRR to the New York TRACON and associated changes in the area of jurisdiction, the annual instrument operations data for N90 were used for FY-77. For subsequent years, the forecast data for N90 and HPN were combined.

The forecasts of instrument operations are not broken down as to aviation category (i.e., AC, AT, GA and MA); however, breakdowns of this nature are reflected in annual activity reports. Therefore, to provide a breakdown to facilitate estimating average times in associated track status on the basis of general performance characteristics, the following assumptions were made:

- The annual instrument operations by MA will remain the same as the value reported for FY-77.
- The annual instrument operations by AC will increase/decrease with respect to the FY-77 reported value by an amount proportionate to changes in the AC itinerant operations forecast.
- The remainder of the total forecast operations represents the annual instrument operations by AT and GA. A further break out of these two groups was not undertaken since the data available does not lend itself to such a breakout and, in the case of instrument operations, GA is assumed to be made up predominantly of light twin-engine aircraft similar in performance to AT, thus, the breakout is not essential in the estimating process.

3.2 Estimation of Busy Hour Associated Tracks.

Following the same approach used in the IAC estimation process (see paragraph 1.2), busy/average hour relationships as a function of total annual instrument operations were developed from busy hour and annual instrument operations activity data reported in FY69, FY72, FY73 and FY76 by approach control facilities having 300,000 or more annual instrument operations. The results of this effort are depicted in Exhibit A-2 and are represented by the equation,

$$\text{Busy/Average Hour Ratio} = 2.51e^{-.001x} + 1$$

where x = annual instrument operations (in thousands)

Unlike the IAC busy hour estimates, the question of different airports experiencing their busy hour at different times does not arise in this case since the ratio derived is from the forecast annual value for one facility, not a combination from different forecast annual values for a number of airports. Consequently, the instantaneous associated track estimates (for the poor weather conditions) are based on the above busy/average hour ratio equation, i.e., different (A, B and C) ratios, as pursued in the IAC estimates, are not applied in this case. The instantaneous associated track estimates for good weather conditions are derived simply from the assumption that they are equal to 75% of the poor weather values. This is based on the notion that in good weather conditions, the delay experienced by individual aircraft will be less and thus their time in associated track status will be less.

The composition of busy hour instrument operations by AC, MA and (AT + GA) is computed as follows:

$$N = \frac{\text{Annual Value (AC, MA or AT + GA)}}{8760} \cdot \text{Busy/Average Hour Ratio}$$

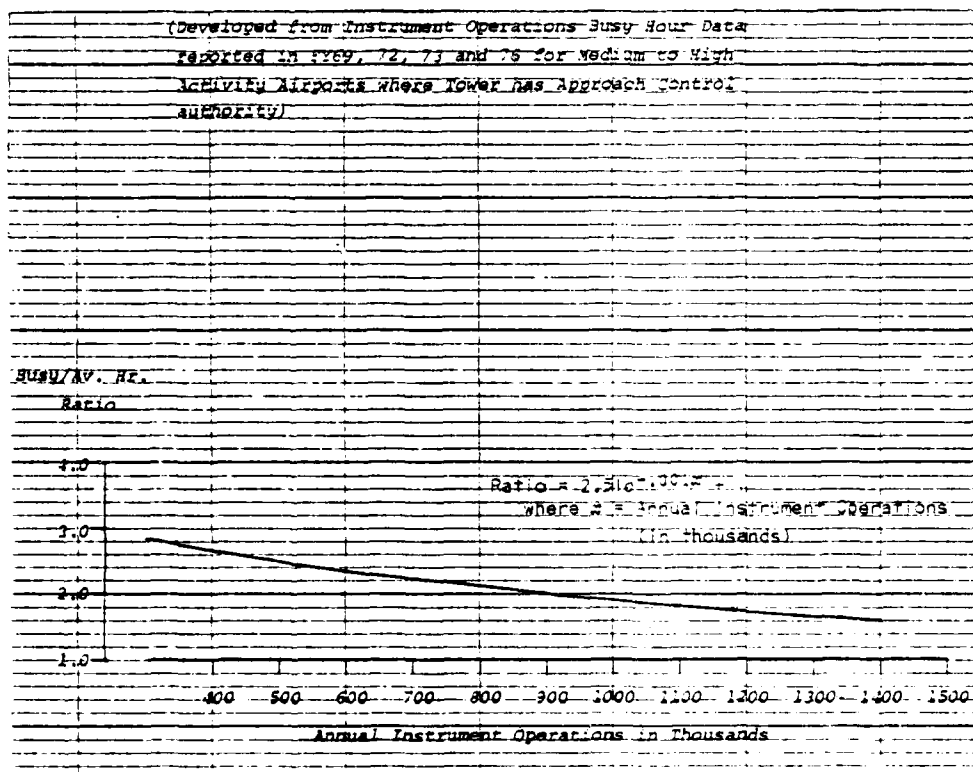


EXHIBIT A-2
 Busy/Average Hour Relationship
 as a Function of Annual Instrument Operations

3.3 Estimation of Instantaneous Associated Tracks in the System.

The conversion of busy hour estimates to estimates of the instantaneous number of associated tracks in the system is based on estimates of the average time each flight is in associated track status. This, in turn, requires estimates of the distance flown and flight profiles (i.e., speed and altitude) relative to the different aviation categories as well as the adoption of assumptions regarding radar coverage and arrival/departure ratios. The estimates/assumptions made for this purpose were as follow:

- AC and MA have the same general performance characteristics and will average the same time in associated track status.
- AT and GA involved in instrument operations have the same general performance characteristics and will average the same time in associated track status.
- The average path length for arrivals in associated track status during the busy hour is 67.5 miles.*
- The average path length for departures in associated track status during the busy hour is 33.75 miles.*
- The ratio of arrivals to departures during the busy hour is 3:1.
- The average time overflights are in associated track status is equal to the weighted arrival/departure average.
- Radar coverage is not a factor (i.e., procedures for handling instrument operations in a radar control environment are generally designed to retain controlled aircraft in surveillance coverage to the maximum extent practical).

The estimated time in associated track status based on the above assumptions and estimated speeds for the different categories are as follow:*

	Arrivals	Departures	Weighted Average
AC & MA	19:18	9:43	16:54
AT & GA	23:54	11:53	20:54

where time is expressed in minutes and seconds.

(* The hypothetical geometry and flight profiles assumed in deriving the estimates are presented in Appendix F.)

Based on the foregoing, computation of the average associated track count during the busy hour is accomplished as follows:

$$N = .2817(\text{Busy Hr AC} + \text{MA}) + .3483(\text{Busy Hr AT} + \text{GA})$$

where .2817 and .3483 represent the average hours (in decimal) that each of the different categories is in associated track status.

Since the above results represent the average instantaneous associated track count during a busy hour and the count will obviously fluctuate above and below the average during the course of the hour, a peaking factor of 1.2 is subsequently applied to estimate the peak instantaneous associated track count during a busy hour. The factor of 1.2 is based on past observations of peak to average instantaneous tracks during busy hour operations at the New York CIFRR.

3.4 Beacon Assumptions Pertaining to Associated Tracks.

Inasmuch as associated tracks represent controlled flights, it is reasonable to assume that the vast majority are associated with beacon equipped aircraft. The specific assumptions made in determining the distribution of associated tracks by the Radar Only and Beacon categories were as indicated in the following table:

- Percent of Total Associated Tracks -

	FY77	FY80	FY82	FY84	FY86	FY88	FY90
Beacon Equipped	95	96	97	38	99	99	99
Discrete Code	75	80	83	86	89	92	95
Mode C	75	80	83	86	89	92	95
Radar Only	5	4	3	2	1	1	1

3.5 Distribution of Associated Tracks by Surveillance Site.

Estimates of the instantaneous associated track counts made thus far in the process relate to the overall system. However, with the ARTS IIIA system, associated tracks are correlated in the radar system corresponding to the one used for display by the controller position having control jurisdiction over the flight. Therefore, for the locations where surveillance data is provided from more than one surveillance site, it is necessary to estimate the distribution between the various sites. In practice, it is probable that the distributions are related to the configurations and operating practices applied at the particular facility. For purposes of estimating, it is assumed that there is some general relationship between the airports having the bulk of the activity and the surveillance sites closest to those airports. The assumed distributions for the facilities in this study were as follow:

New York : JFK (35%); EWR (35%); HPN (15%); ISP (15%)

Chicago : ORD (70%); CHI-S (30%)

Los Angeles : LAX₄ (55%); LAX₇ (45%)

3.6 Unassociated/Associated Track Cross-Linking.

In ARTS IIIA, unassociated tracks in one surveillance system that correspond to associated tracks in another surveillance system (i.e., are deduced to be the same aircraft) are cross-linked for purposes of changing the display

symbology that would otherwise be presented for the unassociated track. The occurrence of this condition is a function of the overlap in coverage of the particular surveillance sites in areas where tracks are in an associated track status. The general assumptions made relevant to estimating the number of unassociated tracks that are cross-linked with associated tracks are as follow:

- The average range of an associated track on an arrival when it first becomes an associated track is 45 miles from the surveillance site with which it is associated.
- The average range of an associated track on departures when it is handed off and the track becomes an unassociated track is 25 miles from the surveillance site with which it was associated.
- The altitude of the associated arrival/departure flight is such that detection by the other surveillance system/s is not line-of-sight limited.

The foregoing assumptions imply that the number of associated tracks in surveillance system "A" that would be cross-linked with unassociated tracks in surveillance system "B" is a function of the percent the surveillance site A's area covering associated tracks is overlapped by surveillance site B's coverage. For example, surveillance site A's associated track area for departures is a circle having a radius of 25 miles. Surveillance site B's assumed coverage is a circle having a 60 mile radius. For arrivals, surveillance site A's associated track area is a circle having a radius of 45 miles while surveillance site B's assumed coverage area remains a circle having a 60 mile radius. The number of unassociated tracks of surveillance site B that are cross-linked with associated tracks of surveillance site A is equal to the percent of surveillance site A's associated tracks on departures that lie within the area where the 25 mile radius and 60 mile radius circles overlap plus the percent of surveillance site A's associated tracks on arrivals that lie within the area where the 45 mile radius and 60 mile radius circles overlap. In line with the earlier arrival/departure ratio

symbology that would otherwise be presented for the unassociated track. The occurrence of this condition is a function of the overlap in coverage of the particular surveillance sites in areas where tracks are in an associated track status. The general assumptions made relevant to estimating the number of unassociated tracks that are cross-linked with associated tracks are as follow:

- The average range of an associated track on an arrival when it first becomes an associated track is 45 miles from the surveillance site with which it is associated.
- The average range of an associated track on departures when it is handed off and the track becomes an unassociated track is 25 miles from the surveillance site with which it was associated.
- The altitude of the associated arrival/departure flight is such that detection by the other surveillance system/s is not line-of-sight limited.

The foregoing assumptions imply that the number of associated tracks in surveillance system "A" that would be cross-linked with unassociated tracks in surveillance system "B" is a function of the percent the surveillance site A's area covering associated tracks is overlapped by surveillance site B's coverage. For example, surveillance site A's associated track area for departures is a circle having a radius of 25 miles. Surveillance site B's assumed coverage is a circle having a 60 mile radius. For arrivals, surveillance site A's associated track area is a circle having a radius of 45 miles while surveillance site B's assumed coverage area remains a circle having a 60 mile radius. The number of unassociated tracks of surveillance site B that are cross-linked with associated tracks of surveillance site A is equal to the percent of surveillance site A's associated tracks on departures that lie within the area where the 25 mile radius and 60 mile radius circles overlap plus the percent of surveillance site A's associated tracks on arrivals that lie within the area where the 45 mile radius and 60 mile radius circles overlap. In line with the earlier arrival/departure ratio

assumption, associated tracks on departures are assumed to be 25% of the total associated tracks and associated tracks on arrivals are assumed to be 75% of the total associated tracks. The ratio of the overlap area to the 25 and 45 mile radius circles around surveillance site A is, of course, dependant on the distance (d) between the two surveillance sites.

Where there is more than one "other" surveillance system, as is the case with New York, separate computations are made for each of the other systems and the results are summed to determine the number of unassociated tracks that are cross-linked with associated tracks in another system.

The computations used to determine the number of unassociated tracks that are cross-linked are as follow:

$$N = po_d(.25(\text{Total Associated Tracks in other system})) + po_a(.75(\text{Total Associated Tracks in other system}))$$

where:

po_d = percent 25 mile radius circle around surveillance site A is overlapped by 60 mile radius circle around surveillance site B.

po_a = percent 45 mile radius circle around surveillance site A is overlapped by 60 mile radius circle around surveillance site B.

The equation used to determine CR in the computation of Group 2, Local Flights (see paragraph 1.3.2) is also used to determine po_d and po_a by substituting values in the equation as follows:

where: d = distance between surveillance sites.

ROSC = radius of surveillance coverage for site B = 60

atr = associated track radius. For po_d , atr = 25; for

po_a , atr = 45.

then:

For $d \leq (ROSC - atr)$, $po = 1$

For $d \geq (ROSC + atr)$, $po = 0$

Where $(ROSC - atr) < d < (ROSC + atr)$, po is determined as follows:

$$po = \frac{1}{100\pi} \left[atr^2 \left(\frac{\pi \angle B}{180} - \sin \angle B \cos \angle B \right) + ROSC^2 \left(\frac{\pi \angle A}{180} - \sin \angle A \cos \angle A \right) \right]$$

$$\text{where } \angle A = \arccos \left(\frac{d^2 + ROSC^2 - atr^2}{2 \cdot ROSC \cdot d} \right)$$

$$\text{and } \angle B = \arccos \left(\frac{d^2 + atr^2 - ROSC^2}{2 \cdot atr \cdot d} \right)$$

4 Merging and Finalizing the Estimates of IAC System Load Factors.

Application of the preceding processes produce tentative values for all of the IAC system load factors except the Radar Only, Beacon Only and Radar Reinforced Beacon values for Unassociated Tracks. The purpose of this step is to derive these values and to finalize the tentative IAC base values and the tentative target report values.

In the ARTS IIIA system, the system attempts to automatically initiate and maintain tracks on all aircraft operating within the coverage area of the surveillance systems providing it inputs. Tracks for which the controlling position has been determined (either from flight plan data or keyboard inputs) are termed associated tracks. As previously noted, these tracks equate to airborne aircraft receiving terminal radar services from the facility served by the system. All other tracks are termed unassociated tracks. On the premise that the system does not generally track noise (false targets) and is capable of coasting tracks through momentary target loss situations, the determination of unassociated tracks would appear to be simply a matter of subtracting the associated track values from the IAC

base values. This would indeed be the case if it were not for two complicating factors. One is that the application of probability of detection assumptions in converting IAC base values to target report values resulted in some redistribution between the Radar Only, Beacon Only and Radar Reinforced Beacon categories. The other is that the IAC base values and the associated track values were independantly derived and use different assumptions regarding beacon equippage and code assignments. It is therefore possible in merging the data to encounter situations where the number of unassociated tracks in a particular category is a negative value. When this occurs, it is necessary to modify the tentative IAC base values (as well as the tentative target report values) to rectify the condition.

The equations used to determine tentative values for the unassociated track breakdown are contained in Table A-6. If no negative values are produced, then these values along with the tentative IAC base and tentative target report values represent the final set of values. If, on the other hand, one or more negative numbers are produced, adjustments are made to the tentative IAC base and tentative target report values with the amount of adjustment determined by the absolute value of the negative number. These modified values then represent the final set of values for the IAC system load factors.

TABLE A-6

DETERMINATION OF UNASSOCIATED TRACK VALUES
FROM BASE VALUES AND ASSOCIATED TRACK VALUES

- Legend -

RO = Radar Only
 BO = Beacon Only
 RRE = Radar Reinforced Beacon
 Subscript "b" = Base value (i.e., estimated number of targets if the probability of detection were 100% and there were no false targets)
 Subscript "at" = Associated tracks
 Subscript "ut" = Unassociated tracks
 Prefix "d" = Discrete code
 Prefix "n" = Non discrete code
 Prefix "c" = Mode C
 RPD = Radar probability of detection (parameter; assumed value = .96)
 BPD = Beacon probability of detection (parameter; assumed value = .96)

- Equations -

$$\begin{aligned} \text{Total}_{ut} &= RO_{ut} + BO_{ut} + RRB_{ut} \\ RO_{ut} &= RO_b + RRB_b(1 - BPD) - RO_{at} \\ BO_{ut} &= dBO_{ut} + nBO_{ut} \\ dBO_{ut} &= dBO_b + dRRB_b(1 - RPD) - dBO_{at} \\ nBO_{ut} &= nBO_b + nRRB_b(1 - RPD) - nBO_{at} \\ cBO_{ut} &= cBO_b + cRRB_b(1 - RPD) - cBO_{at} \\ RRB_{ut} &= dRRB_{ut} + nRRB_{ut} \\ dRRB_{ut} &= dRRB_b - dRRB_b((1 - RPD) + (1 - BPD)) - dRRB_{at} \\ nRRB_{ut} &= nRRB_b - nRRB_b((1 - RPD) + (1 - BPD)) - nRRB_{at} \\ cRRB_{ut} &= cRRB_b - cRRB_b((1 - RPD) + (1 - BPD)) - cRRB_{at} \end{aligned}$$

APPENDIX B

BUSY/AVERAGE HOUR RATIOS VS. TOTAL ANNUAL OPERATIONS

BUSY HOUR/AVERAGE HOUR RATIOS VS. TOTAL ANNUAL OPERATIONS

(For Airports with 24 Hr/Day Tower Operations)

An analytical expression for the Busy Hour/Average Hour Ratio (y) as a function of the total annual operations ($\div 1,000, = x$) was derived from the following assumptions:

- (1) As the total annual operations for any airport becomes large, increases in traffic loads are spread out over more hours of the day. Any given airport system will operate at maximum load only by spreading out the traffic load evenly over all 24 hours of the day, with a resulting $y = 1$. On the other hand, airports with very low traffic loads will presumably not be operating at maximum capability. For reasons of convenience, peak loads can be expected to occur in such systems, producing a $y > 1$.

Assumption: For small x , $y > 1$; but y asymptotically approaches 1 for large values of x .

- (2) As a preliminary approach to this problem, airports were placed in groups corresponding to specific ranges of x , and the average y was calculated for each group. When (\bar{y} , x midpoint of range) points were compared, they did indicate a monotonically decreasing function. This function dropped more slowly than x^{-1} , and therefore more slowly than x^{-n} , for any integral n . An exponential fit was then attempted for $(y - 1)$, since e^{-mx} will approach zero asymptotically for large x , and since the initial slope of the dropoff can be adjusted by adjusting the value of m . The fit looked good.

Assumption: $y = ce^{-mx} + 1$, when c and m are constants

In order to evaluate the constants c and m , and to obtain some statistical verification of these assumptions, it was noted that, if they were true, one could write

$$y - 1 = ce^{-mx}.$$

Then, by taking the natural logarithms of both sides, one obtains

$$\ln(y - 1) = \ln c - mx.$$

Since this expression is linear in x , standard linear regression analyses were performed on the transformed sample points $[\ln(y - 1), x]$.

Data points were available for four separate years; 1969, 1972, 1973 and 1976. Regressions were performed separately for each particular year, and for all the years taken together in one combined sample. The results of these regressions are as follow:

Year	Number of Airports	c	$\ln c$	m	Correlation Coefficient
1969	204	8.37	2.12	-.0031	-.59
1972	212	9.07	2.20	-.0036	-.61
1973	209	9.34	2.23	-.0038	-.67
1976	200	8.10	2.09	-.0034	-.61
Combined	825	8.72	2.17	-.0035	-.62

Note that the calculated values hold relatively constant from year to year, and that the correlation coefficient holds steady at the high value of approximately -0.6. It is therefore reasoned that the result obtained from the combined sample points provides a valid tool for estimating busy hour operations at an airport given a forecast of total annual operations for that airport. In other words, that

$$y = 8.72e^{-.0035x} + 1$$

APPENDIX C

PERFORMANCE ASSUMPTIONS FOR AIRCRAFT CATEGORIES

PERFORMANCE ASSUMPTIONS FOR AIRCRAFT CATEGORIES

Aircraft proceed directly to/from the airport except that an additional 10 miles is flown in the vicinity of the airport while maneuvering to land or immediately after takeoff.

GA consists predominantly of aircraft with characteristics similar to Cessna 150's and 172's.

AT consists predominantly of light twins with characteristics similar to Cessna 310's and Beechcraft 99's.

AC consists predominantly of aircraft with characteristics similar to Boeing 727's.

MA consists predominantly of aircraft with characteristics similar to air carriers.

The airport elevation is 0 feet MSL.

The assumed performance of each aviation category related to flight path distance from the runway is as follows:

Flight Path Distance	0	5	10	20	40	70
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GA

Av. Alt (MSL)	500'	1,000'	1,000'	3,000'	3,000'
Av. IAS	85	100	100	110	110
Av. TAS	86	101	101	115	115
Time to Fly	3:29	2:58	5:56	10:26	15:39

AT

Av. Alt (MSL)	500'	1,000'	1,000'	4,000'	8,000'
Av. IAS	95	110	150	190	190
Av. TAS	96	112	152	202	214
Time to Fly	3:08	2:41	3:57	5:56	8:24

AC & MA

Av. Alt (MSL)	500'	1,000'	2,000'	9,000'	20,000'
Av. IAS	135	180	210	230	350
Av. TAS	136	183	216	263	479
Time to Fly	2:12	1:38	2:47	4:34	3:45

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STERLING SYSTEMS INC WASHINGTON DC F/O 17/7
ASSESSMENT OF THE CAPACITY OF THE AUTOMATED RADAR TERMINAL SYST--ETC(U)
JUN 80 W PAILEN, H C WINTERMOYER, R SITTLER DOT-FA76WAI-942

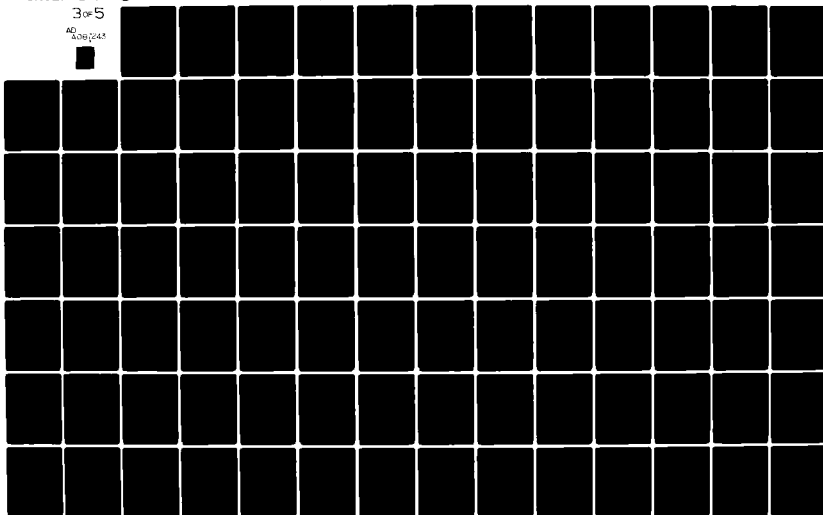
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APPENDIX D

SURVEILLANCE DETECTABILITY AND
SHIELDING ASSUMPTIONS

RADAR DETECTABILITY ASSUMPTIONS

Estimates of radar cross section and radar range based on information contained in "Excerpts from PRIMARY/SECONDARY TERMINAL RADAR SITING HANDBOOK, July 20, 1976, Order 6310.6"

Aviation Category	Average Altitude	Radar Cross Section*		(Unshielded)	
		Sq. Meters	dB, ret to 2.2 m ²	Radar Range (ASR-8**)	Beacon Range (ATCBI-4)
ITINERANT					
GA	2500	2.8	+1	51	58 (LOS)
AT	4000	3.5	+2	57	60
AC & MA	8500	12	+7.5	60	60
GROUP 2 LOCALS					
GA	1000	2.8	+1	38.5 (LOS)	38.5 (LOS)
MA	1000	12	+7.5	38.5 (LOS)	38.5 (LOS)

* Values for types of aircraft of interest are not given in the cited Handbook. Estimated values relate to given values as follow:

Sq. Meters 2.8 Equal to F4 and F86. Greater than T33 and F84 (2.2) and less than F100 (3.5) and DC-3 (11).

3.5 Equal to F100. Greater than T33, F84, F4 and F86 and less than F106 (4.4) and DC-3.

12 Not equal to any given value. Greater than DC-3 and less than B707 (13.8) and DC-8 (17.4).

** Assumes ASR-8 operating with linear polarization.

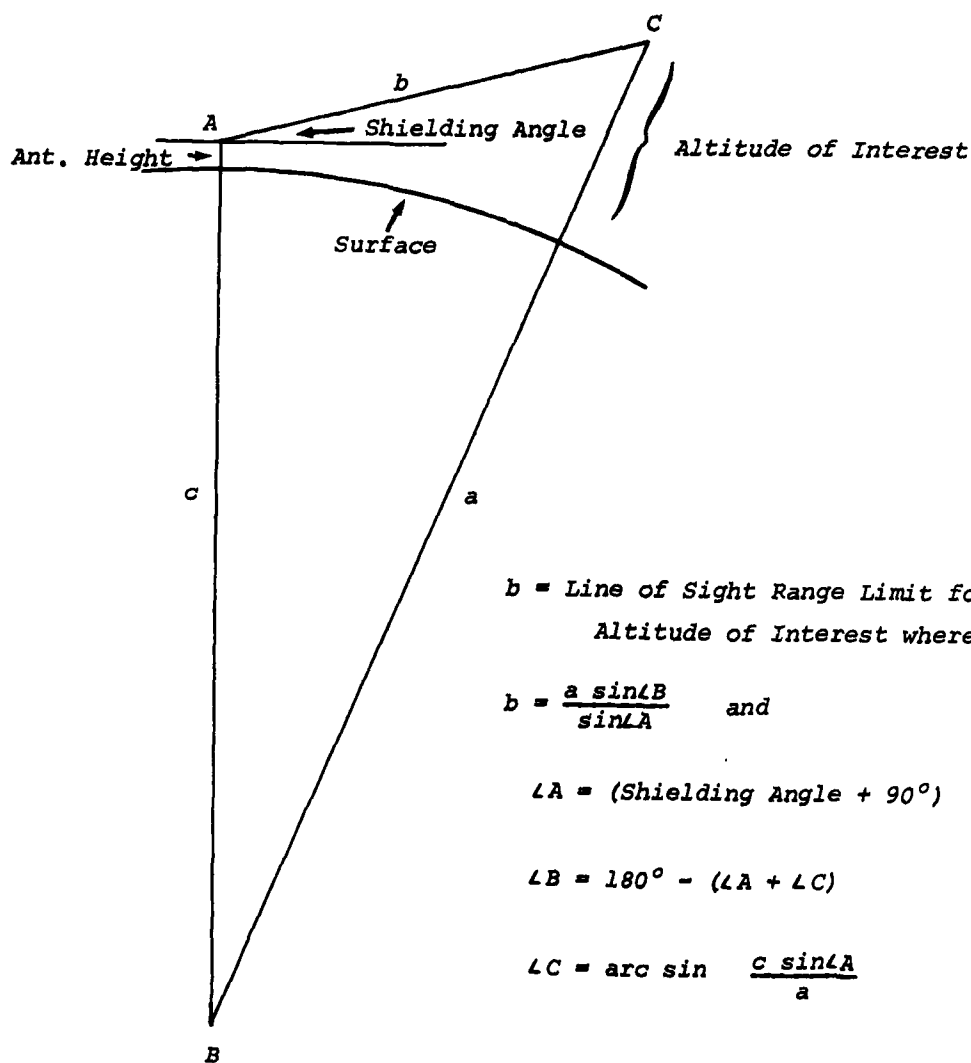
(LOS) = Line of sight limitation due to earth curvature effect based on the following assumptions:

Antenna height = 21 feet (17 foot pedestal + 1/2 eight foot sail)

Aircraft height = Average altitude.

Mean earth radius = 3,440.07 International Nautical Miles

International Nautical Mile = 6076.11549 feet.



Computation of Radius of Surveillance Coverage at Altitudes of Interest

RADIUS OF SURVEILLANCE COVERAGE
(With Shielding Assumptions Applied)

Av. Alt. (x 100)			85	40	25	85	25	85	85	40	25	85	25	85	10
TRACON	Surv. Site	Shielding \angle	RADAR						BEACON						Radar & Beacon Gp. 2 Local
			--Itinerant---				Gp. 1 Local		--Itinerant---				Gp. 1 Local		
			AC	AT	GA	MA	GA	MA	AC	AT	GA	MA	GA	MA	
N90	JFK	.33	60	50	37	60	37	60	60	50	37	60	37	60	18.9
	EWR	.6	60	40	28	60	28	60	60	40	28	60	28	60	13.0
	HPN	.5	60	44	31	60	31	60	60	44	31	60	31	60	14.8
	ISP	.3	60	52	38	60	38	60	60	52	38	60	38	60	19.9
ORD	ORD	.25	60	54	40	60	40	60	60	54	40	60	40	60	21.5
	CHI-S	.25	60	54	40	60	40	60	60	54	40	60	40	60	21.5
LAX	LAX ₄	*	59	36	26	59	26	59	59	36	26	59	26	59	15.9
	LAX ₇	*	59	36	26	59	26	59	59	36	26	59	26	59	15.9
DTW	DTW	None	60	57	51	60	51	60	60	60	58	60	58	60	38.5

* LAX Shielding Angle = 1° (all ranges). Average Altitude increased 930'
(the average elevation of airports in data base).

APPENDIX E

CALCULATION OF THE RATIO OF THE OVERLAP OF TWO
OVERLAPPING CIRCLES TO THE AREA OF THE SMALLER CIRCLE

CALCULATION OF THE RATIO OF THE OVERLAP AREA OF TWO OVERLAPPING CIRCLES TO THE AREA OF THE SMALLER CIRCLE

This problem arises in estimating the percentage of Group 2 local flights operating in the immediate vicinity of an airport that fall within the radius of surveillance coverage (ROSC) of a particular surveillance site. It also arises in estimating the percentage of associated tracks in one surveillance system that are cross-linked with unassociated tracks in another surveillance system.

In the case of the Group 2 local flights, the smaller circle is called the airport circle and has a radius of 10 miles. The radius of the larger circle (ROSC) varies depending on shielding angle assumptions related to the specific surveillance site. The value of "d" is equal to the distance between the particular surveillance site and the particular airport.

In the cross-link case, the smaller circle represents the associated track area. The radius of the associated track area (atr) is either 25 miles or 45 miles depending on whether the associated tracks are on departures or arrivals. The larger circle, ROSC, represents the radius of surveillance coverage of the surveillance system with the unassociated tracks. It is assumed to be 60 miles. The value of "d", in this case, is equal to the distance between the two surveillance sites.

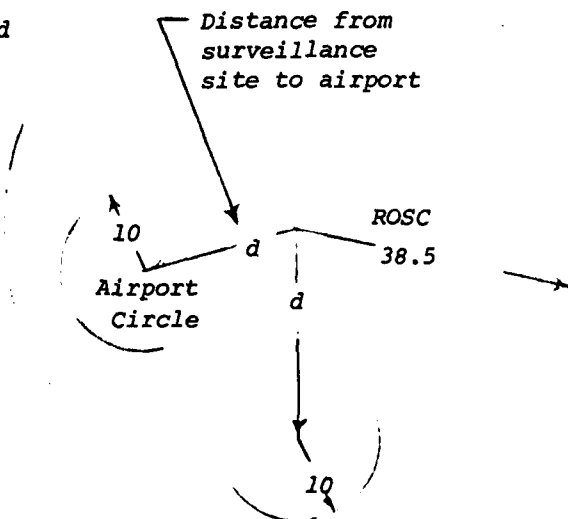
For purposes of illustration, the examples that follow are based on the case of Group 2 local flights with ROSC having an assumed value of 38.5 miles. The same equations are applied to the other cases by substituting the appropriate values.

Case I: The airport circle is contained entirely within ROSC. The area of overlap is the area of the airport circle, divided by the area of the airport circle which produces

$$CR = 1$$

Case I occurs when

$$d \leq (38.5 - 10)$$



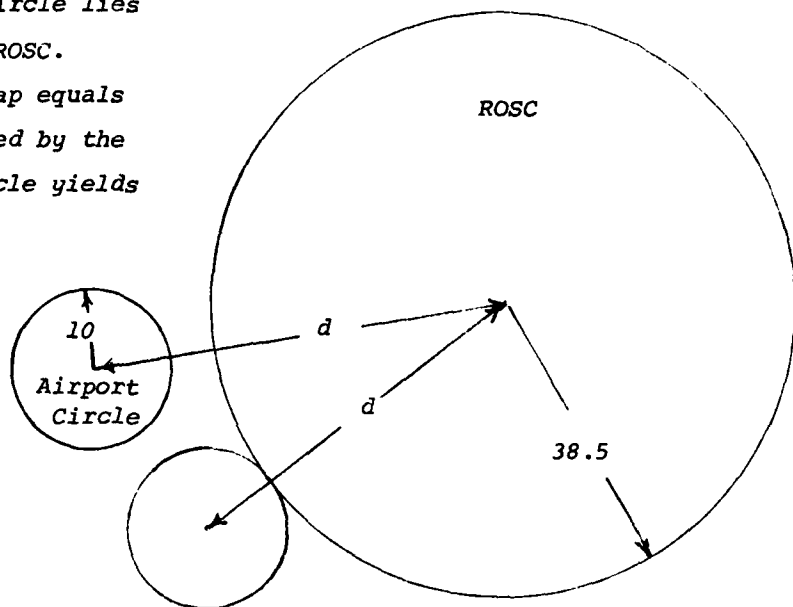
Case II: The airport circle lies completely outside the ROSC.

Here, the area of overlap equals zero, which, when divided by the area of the airport circle yields

$$CR = 0$$

Case II occurs when

$$d \geq (38.5 + 10)$$

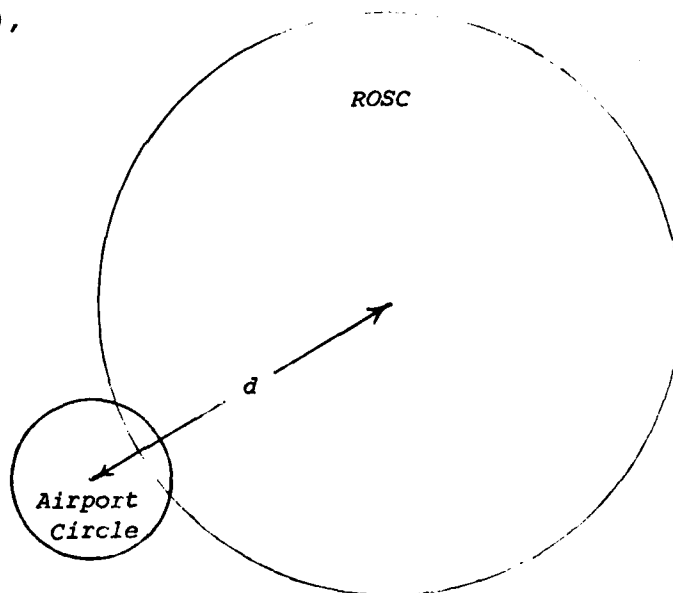


Case III: The airport circle lies neither totally within nor totally outside ROSC.

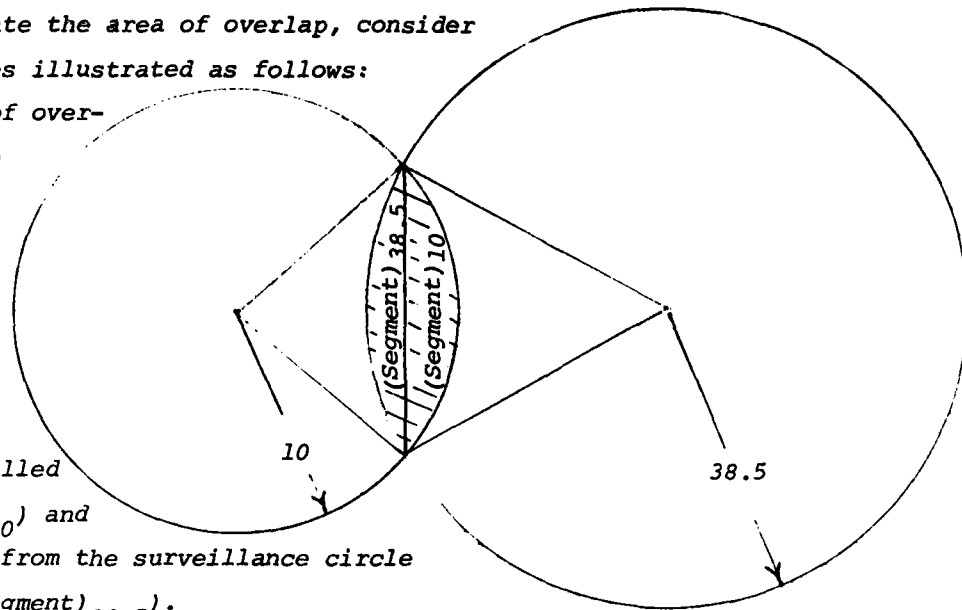
Case III occurs when

$$28.5 \leq d \leq 48.5$$

The area of overlap will range all the way from zero (at $d = 48.5$), producing a $CR = 0$, up to the area of the airport circle (at $d = 28.5$), producing a $CR = 1$.



To calculate the area of overlap, consider the circles illustrated as follows:
 The area of overlap can be seen to equal the sum of a segment from the airport circle (called (Segment)₁₀) and a segment from the surveillance circle (called (Segment)_{38.5}).



Considering the two circles again, we find a triangle of sides 10, 38.5, and d . Since for any particular case d is known, we can compute $\angle 10$ (opposite side 10) and $\angle 38.5$ (opposite side 38.5) by the Law of Cosines.

In a triangle with sides a , b , c , the $\angle C$ opposite side c is given by the Law of Cosines as

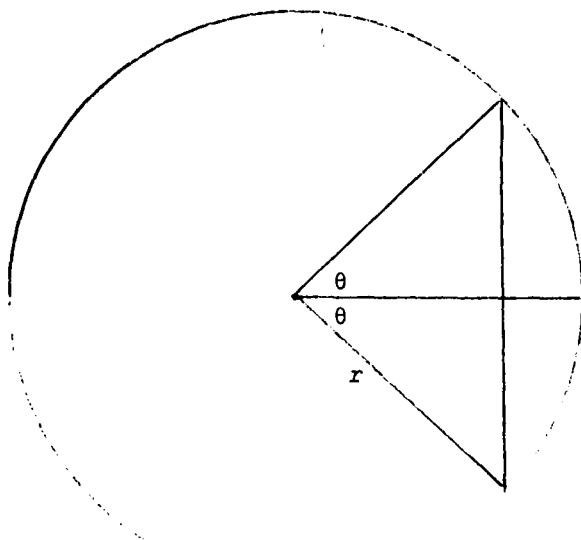
$$\angle C = \arccos \left(\frac{a^2 + b^2 - c^2}{2ab} \right)$$

In our own particular case,

$$\angle 10 = \arccos \left(\frac{d^2 + 38.5^2 - 10^2}{2 \cdot 38.5 \cdot d} \right) \quad \text{and}$$

$$\angle 38.5 = \arccos \left(\frac{d^2 + 10^2 - 38.5^2}{2 \cdot 10 \cdot d} \right)$$

Now, how do we find the area of a segment? The general case is illustrated below:



The segment area can be found by subtracting the triangular area from the area of the sector.

The area of the sector will be equal to

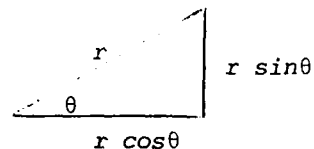
$$\pi r^2 \cdot \frac{2\theta}{360^\circ}, \text{ since } \frac{2\theta}{360^\circ}$$

represents the proportion of the circle's area which is subtended by the sector.

The triangular area can be found by examining the smaller triangles, one of which is illustrated below:

The height of the triangle = $r \sin \theta$

The base of the triangle = $r \cos \theta$



So, the area of one of the smaller triangles will be

$$\frac{r \sin \theta \cdot r \cos \theta}{2}$$

And, since there are two of them, the total triangular area will be

$$r^2 \sin \theta \cos \theta.$$

Finally, we can carry out the subtraction and write the segment area as

$$\pi r^2 \cdot \frac{2\theta}{360^\circ} - r^2 \sin \theta \cos \theta = r^2 \left(\frac{\pi \theta}{180^\circ} - \sin \theta \cos \theta \right).$$

Returning to our specific problem, we can then write the area of overlap as equal to the sum of the segment areas as follows:

$$10^2 \left(\frac{\pi 38.5}{180} - \sin 38.5 \cos 38.5 \right) + 38.5^2 \left(\frac{\pi 10}{180} - \sin 10 \cos 10 \right)$$

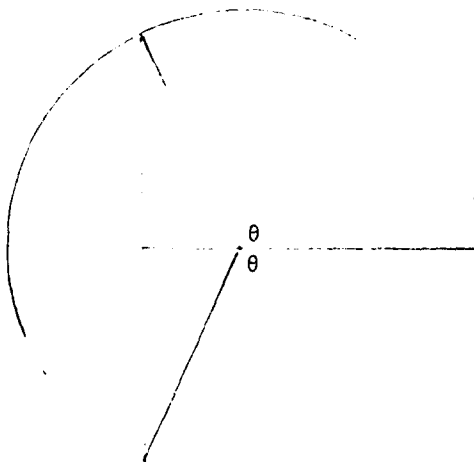
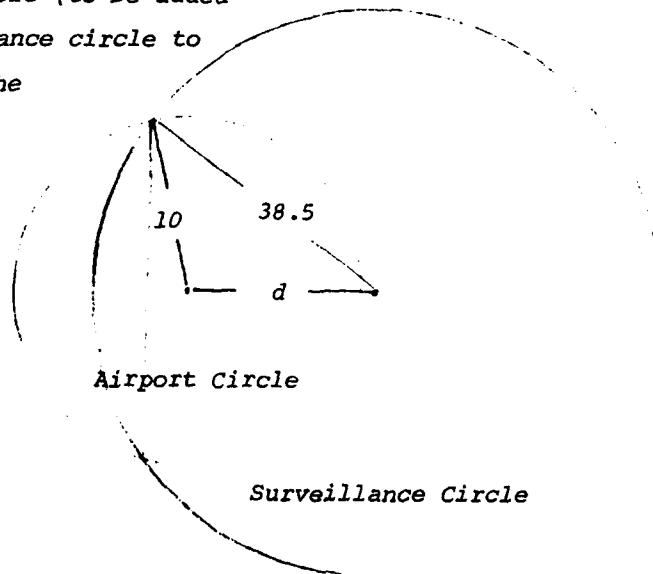
Which, when divided by the area of the airport circle, yields the coverage ratio.

Determination of the coverage ratio (CR) may then be stated as

$$CR = \frac{1}{100\pi} \left[10^2 \left(\frac{\pi \angle 38.5}{180} - \sin \angle 38.5 \cos \angle 38.5 \right) + 38.5^2 \left(\frac{\pi \angle 10}{180} - \sin \angle 10 \cos \angle 10 \right) \right]$$

Note -- when the intersection is as illustrated here, 38.5 is obtuse and the segment from the airport circle (to be added to the segment from the surveillance circle to obtain the area of overlap) is the larger segment of the airport circle.

The derived formula, however, still holds under these conditions as illustrated below.



The area of the largest sector is given by $\frac{2\theta}{360} \cdot r^2$, as before.

The triangular area must be added to area of the sector to obtain the area of the larger segment.

So we have

$$\text{Segment area} = \frac{2\theta}{360} \cdot r^2 + \sin(180 - \theta) \cos(180 - \theta) \cdot r^2$$

But -- $\sin(180 - \theta) = \sin \theta$, $\cos(180 - \theta) = -\cos \theta$,

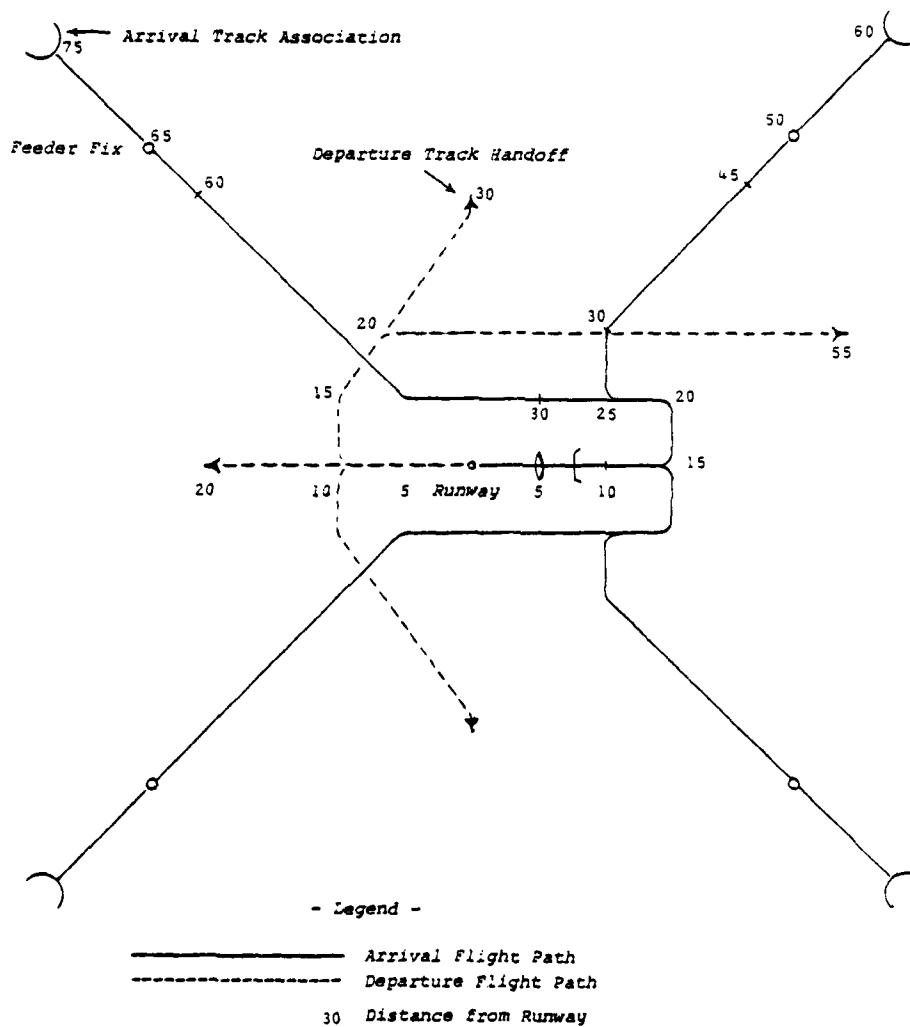
So we have

$$\text{Segment area} = r^2 \left(\frac{\theta\pi}{180} - \sin \theta \cos \theta \right), \text{ and the formula still holds.}$$

APPENDIX F

HYPOTHETICAL GEOMETRY AND FLIGHT PROFILES ASSUMED
IN ESTIMATING AVERAGE LIFE OF ASSOCIATED TRACKS

HYPOTHETICAL GEOMETRY ASSUMED IN ESTIMATING AVERAGE LIFE OF ASSOCIATED TRACKS



FLIGHT PROFILES ASSUMED IN ESTIMATING AVERAGE LIFE OF ASSOCIATED TRACKS

AC and MA Arrivals

Flt Path Distance from Runway	50% of Arrivals				50% of Arrivals			
	-----Average-----				-----Average-----			
	Alt	IAS	TAS	TTF	Alt	IAS	TAS	TTF
0	-----				-----			
5	5	135	136	2:12	5	135	136	2:12
10	10	156	158	1:54	10	156	158	1:54
15	15	160	164	1:50	15	160	164	1:50
20	20	177	183	1:39	20	177	183	1:39
25	25	180	187	1:36	25	180	187	1:36
30	30	203	212	1:25	30	203	212	1:25
35	-----				-----			
40					55	210	228	3:57
45	116	210	249	7:13	-----			
50					75	225	252	1:12
55					-----			
60					95	250	289	2:05
65	148	227	284	1:03	-----			
70	150	250	315	1:54				
75	-----							
	TOTAL TTF: 20:46				17:50			

Average Associated Track Life (AC and MA Arrivals) = 19:18

FLIGHT PROFILES ASSUMED IN ESTIMATING AVERAGE LIFE OF ASSOCIATED TRACKS

AT and GA Arrivals

Flt Path Distance from Runway	50% of Arrivals				50% of Arrivals			
	-----Average-----				-----Average-----			
	Alt	IAS	TAS	TTF	Alt	IAS	TAS	TTF
0								
5	5	95	96	3:08	5	95	96	3:08
10	10	117	119	2:31	10	117	119	2:31
15	10	120	122	2:28	10	120	122	2:28
20	10	159	161	1:52	10	159	161	1:52
25	15	180	184	1:38	15	180	184	1:38
30	20	189	195	1:32	20	189	195	1:32
35								
40					50	190	205	5:52
45								
50	60	190	208	10:06				
55					80	190	214	2:48
60								
65								
70	100	190	221	2:43				
75								
TOTAL TTF:				25:58	21:49			

Average Associated Track Life (AT and GA Arrivals) = 23:54

FLIGHT PROFILES ASSUMED IN ESTIMATING AVERAGE LIFE OF ASSOCIATED TRACKS

AC and MA Departures

Flt Path Distance from Runway	25% of Departures				50% of Departures				25% of Departures			
	-----Average-----				-----Average-----				-----Average-----			
	Alt	IAS	TAS	TTF	Alt	IAS	TAS	TTF	Alt	IAS	TAS	TTF
0	-----				-----				-----			
	10	160	162	1:51	10	160	162	1:51	10	160	162	1:51
5												
	20	185	191	1:34	20	185	191	1:34	20	185	191	1:34
10												
	30	210	220	1:22	30	210	220	1:22	30	210	220	1:22
15												
	30	210	220	1:22	30	210	220	1:22	30	210	220	1:22
20	-----				-----				-----			
25					40	210	223	2:42				
30					-----							
35												
40									80	210	237	8:52
45												
50												
55									-----			
TOTAL TTF:				6:09	8:51				15:01			

FLIGHT PROFILES ASSUMED IN ESTIMATING AVERAGE LIFE OF ASSOCIATED TRACKS

AT and GA Departures

Flt Path Distance from Runway	25% of Departures				50% of Departures				25% of Departures			
	-----Average-----				-----Average-----				-----Average-----			
	Alt	IAS	TAS	TTF	Alt	IAS	TAS	TTF	Alt	IAS	TAS	TTF
0	5	110	111	2:42	5	110	111	2:42	5	110	111	2:42
5	15	150	153	1:58	15	150	153	1:58	15	150	153	1:58
10	25	175	182	1:39	25	175	182	1:39	25	175	182	1:39
15	30	190	199	1:30	30	190	199	1:30	30	190	199	1:30
20												
25					40	190	202	2:59				
30												
35												
40									50	190	205	10:16
45												
50												
55												
TOTAL TTF:				7:49	10:48				18:05			

Average Associated Track Life (AT & GA Departures) = 11:53

APPENDIX G

IAC SYSTEM LOAD FACTORS FOR THE
NEW YORK TRACON SURVEILLANCE SITES

SYSTEM LOAD VALUES FOR NEW YORK JFK 1977						
BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	143.06	296.62	450.19	91.04	98.52	146.67
RADAR ONLY	39.56	84.34	129.12	5.19	11.03	16.87
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	103.51	212.29	321.07	75.85	87.50	129.81
DISCRETE	44.91	50.27	73.05	59.88	69.80	102.81
NON DISCRETE	58.59	162.01	248.01	15.97	17.70	27.00
MODE C	44.91	90.80	135.08	59.88	59.88	92.68
ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	195.22	351.30	508.38	180.78	201.50	250.42
RADAR ONLY	92.00	139.00	187.00	107.00	114.00	121.00
BEACON ONLY	8.00	17.00	26.00	4.00	7.00	10.00
DISCRETE	2.00	4.00	6.00	3.00	6.00	8.00
NON DISCRETE	6.00	13.00	20.00	1.00	1.00	2.00
MODE C	4.00	7.00	11.00	3.00	5.00	7.00
RADAR REINFORCED BEACON	95.22	195.30	295.38	69.78	80.50	119.42
DISCRETE	41.32	46.25	67.21	55.09	64.21	94.38
NON DISCRETE	53.91	149.05	228.17	14.69	16.28	24.84
MODE C	41.32	83.53	124.27	55.09	55.09	85.26
ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		21			28	
RADAR ONLY		2			2	
BEACON ONLY		1			2	
DISCRETE		1			2	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		18			24	
DISCRETE		14			19	
NON DISCRETE		4			5	
MODE C		16			21	
UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	122	275	429	53	71	119
RADAR ONLY	42	91	140	6	13	20
BEACON ONLY	3	7	12	1	2	3
DISCRETE	1	1	2	0	1	2
NON DISCRETE	2	6	10	1	1	1
MODE C	1	3	4	1	1	3
RADAR REINFORCED BEACON	77	177	277	46	56	96
DISCRETE	27	32	53	36	45	76
NON DISCRETE	50	145	224	10	11	20
MODE C	25	68	108	34	34	64
CROSS-LINKED		38			49	
UNUSED TARGET REPORTS						
	A	B	C	A	B	C
RADAR	54	58	63	103	104	105
BEACON	50	50	50	100	100	100
	4	8	13	3	4	5

SYSTEM LOAD VALUES

FOP
NEW YORK JFK
1980

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	157.17	319.58	482.00	95.41	104.44	155.76
RADAR ONLY	40.95	84.55	128.16	5.34	10.42	15.81
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	116.22	235.33	353.84	90.38	94.02	139.95
DISCRETE	56.48	56.48	75.08	75.31	75.31	109.56
NON DISCRETE	59.74	178.55	278.76	15.06	18.70	30.39
MODE C	56.48	110.23	164.66	75.31	75.31	100.42

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	239.93	376.23	540.54	194.15	208.50	260.75
RADAR ONLY	94.00	141.00	187.00	107.00	114.00	121.00
BEACON ONLY	9.00	19.00	28.00	4.00	8.00	11.00
DISCRETE	2.00	4.00	6.00	3.00	6.00	9.00
NON DISCRETE	7.00	15.00	22.00	1.00	2.00	2.00
MODE C	4.00	9.00	13.00	3.00	5.00	8.00
RADAR REINFORCED BEACON	106.93	216.23	325.54	83.15	86.50	128.75
DISCRETE	51.97	51.97	69.08	69.29	69.29	100.79
NON DISCRETE	54.96	164.26	256.46	13.86	17.21	27.96
MODE C	51.97	101.41	151.49	69.29	69.29	92.39

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		26			34	
RADAR ONLY		2			3	
BEACON ONLY		2			2	
DISCRETE		2			2	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		22			29	
DISCRETE		18			24	
NON DISCRETE		4			5	
MODE C		20			26	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	131	293	455	62	70	121
RADAR ONLY	44	92	140	6	11	18
BEACON ONLY	2	7	12	2	2	3
DISCRETE	0	0	1	1	1	2
NON DISCRETE	2	7	11	1	1	1
MODE C	1	3	6	2	2	3
RADAR REINFORCED BEACON	89	194	303	54	57	100
DISCRETE	34	34	51	45	45	77
NON DISCRETE	51	160	252	9	12	23
MODE C	32	81	131	43	43	66
CROSS-LINKED		47			58	
UNUSED TARGET REPORTS	55	59	64	104	104	106
RADAR	50	50	50	100	100	100
BEACON	5	9	14	4	4	6

SYSTEM LOAD VALUES

FOR
NEW YORK JFK
1982

CASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	164.81	333.79	496.77	130.54	108.48	161.55
ADAR ONLY	39.16	79.50	119.84	4.85	9.87	14.90
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
ADAR REINFORCED BEACON	125.65	251.29	376.92	95.69	98.61	146.66
DISCRETE	61.41	61.41	80.09	81.88	81.88	114.18
NON DISCRETE	64.24	189.88	296.83	13.81	16.73	32.48
MODE C	61.41	124.74	186.16	81.88	81.88	107.19

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	218.60	387.19	556.77	199.04	211.72	266.93
ADAR ONLY	93.00	136.30	180.00	107.00	113.00	120.00
BEACON ONLY	10.00	20.00	30.00	4.00	8.00	12.00
DISCRETE	2.00	4.00	6.00	3.00	6.00	9.00
NON DISCRETE	8.00	16.00	24.00	1.00	2.00	3.00
MODE C	5.00	10.00	15.00	3.00	6.00	9.00
ADAR REINFORCED BEACON	115.60	231.19	346.77	88.04	90.72	134.93
DISCRETE	56.50	56.50	73.69	75.33	75.33	105.05
NON DISCRETE	59.10	174.69	273.08	12.71	15.39	29.88
MODE C	56.50	114.75	171.27	75.33	75.33	98.62

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		27			34	
ADAR ONLY		2			2	
BEACON ONLY		2			2	
DISCRETE		2			2	
NON DISCRETE		0			0	
MODE C		1			1	
ADAR REINFORCED BEACON		23			30	
DISCRETE		20			26	
NON DISCRETE		3			4	
MODE C		21			29	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	137	304	470	67	74	128
ADAR ONLY	42	88	133	7	12	19
BEACON ONLY	3	8	13	2	2	4
DISCRETE	0	0	1	1	1	3
NON DISCRETE	3	8	12	1	1	1
MODE C	1	4	6	2	2	3
ADAR REINFORCED BEACON	92	208	324	58	60	105
DISCRETE	36	36	54	49	49	79
NON DISCRETE	56	172	270	9	11	26
MODE C	35	94	150	46	46	70
CROSS-LINKED		46			60	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
ADAR	50	50	50	100	100	100
BEACON	5	10	15	4	4	6

SYSTEM LOAD VALUES

FOR
NEW YORK JFK
1984

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	172.43	341.16	509.90	104.35	111.61	165.83
RADAR ONLY	38.38	76.54	114.69	4.54	9.10	13.66
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	134.05	264.53	395.21	99.51	102.51	152.17
DISCRETE	65.49	65.49	85.04	87.32	87.32	118.04
NON DISCRETE	68.56	199.14	310.17	12.18	15.19	34.13
MODE C	69.97	136.84	203.71	87.32	87.32	112.60
ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	226.32	398.46	571.59	201.55	215.31	271.00
RADAR ONLY	92.00	134.00	176.00	106.00	113.00	119.00
BEACON ONLY	11.00	21.00	32.00	4.00	8.00	12.00
DISCRETE	2.00	5.00	7.00	3.00	6.00	9.00
NON DISCRETE	9.00	16.00	25.00	1.00	2.00	3.00
MODE C	6.00	11.00	16.00	3.00	6.00	9.00
RADAR REINFORCED BEACON	123.32	243.46	363.59	91.55	94.31	140.00
DISCRETE	60.25	60.25	78.24	80.34	80.34	108.60
NON DISCRETE	63.07	183.21	285.35	11.21	13.97	31.40
MODE C	64.37	125.89	187.41	80.34	80.34	103.59
ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		29			36	
RADAR ONLY		2			2	
BEACON ONLY		2			2	
DISCRETE		2			2	
NON DISCRETE		3			0	
MODE C		1			1	
RADAR REINFORCED BEACON		24			32	
DISCRETE		21			28	
NON DISCRETE		3			4	
MODE C		23			31	
UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	145	313	481	67	75	130
RADAR ONLY	42	85	129	7	11	18
BEACON ONLY	4	9	13	1	2	4
DISCRETE	1	1	1	1	1	3
NON DISCRETE	3	8	12	0	1	1
MODE C	2	4	7	2	2	4
RADAR REINFORCED BEACON	99	219	339	59	62	108
DISCRETE	39	39	57	52	52	81
NON DISCRETE	60	180	282	7	10	27
MODE C	41	103	164	49	49	73
CROSS-LINKED		49			64	
UNUSED TARGET REPORTS						
	A	B	C	A	B	C
RADAR	55	51	66	104	104	106
BEACON	50	50	50	100	100	100
	5	11	16	4	4	6

SYSTEM LOAD VALUES

FOR
NEW YORK JFK
1986

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	178.32	349.17	523.03	138.39	113.74	168.67
RADAR ONLY	36.96	72.76	108.57	4.15	8.20	12.25
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	141.35	276.41	411.47	103.94	105.54	156.42
DISCRETE	70.08	70.08	89.30	93.44	93.44	123.84
NON DISCRETE	71.28	206.33	322.17	10.50	12.10	35.58
MODE C	77.79	151.25	224.73	93.44	93.44	117.92
ADJUSTED						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	232.05	407.30	582.55	205.63	217.10	274.91
RADAR ONLY	91.00	131.00	171.00	106.00	112.00	118.00
BEACON ONLY	11.00	22.00	33.00	4.00	8.00	13.00
DISCRETE	3.00	5.00	7.00	3.00	7.00	10.00
NON DISCRETE	8.00	17.00	26.00	1.00	1.00	3.00
MODE C	6.00	12.00	18.00	3.00	6.00	9.00
RADAR REINFORCED BEACON	130.05	254.30	378.55	95.63	97.10	143.91
DISCRETE	64.48	64.48	82.16	85.97	85.97	111.18
NON DISCRETE	65.57	189.82	296.39	9.66	11.13	32.73
MODE C	71.57	139.16	236.76	85.97	85.97	108.48
ASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		29			38	
RADAR ONLY		1			2	
BEACON ONLY		2			3	
DISCRETE		2			3	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		26			33	
DISCRETE		23			30	
NON DISCRETE		3			3	
MODE C		25			33	
UNASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	150	320	491	70	75	131
RADAR ONLY	42	83	124	6	10	17
BEACON ONLY	4	9	15	1	1	3
DISCRETE	1	1	2	1	1	2
NON DISCRETE	3	8	13	0	0	1
MODE C	2	5	8	3	3	4
RADAR REINFORCED BEACON	104	229	352	63	64	111
DISCRETE	41	41	59	56	56	81
NON DISCRETE	63	187	293	7	8	30
MODE C	47	114	182	53	53	75
CROSS-LINKED		52			66	
UNUSED TARGET REPORTS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	56	51	66	104	104	106
RADAR	50	50	50	100	100	100
BEACON	6	11	16	4	4	6

SYSTEM LOAD VALUES

FDR

NEW YORK JFK

1989

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	183.87	356.32	528.78	112.90	116.13	171.78
RADAR ONLY	33.65	65.47	97.28	3.70	7.24	10.77
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	150.21	290.96	431.50	109.19	108.93	161.01
DISCRETE	76.10	76.10	94.19	101.47	101.47	123.53
NON DISCRETE	74.11	214.76	337.31	7.72	7.43	37.48
MODE C	85.97	165.98	245.79	101.47	101.47	123.32
ADJUSTED						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	238.20	414.59	592.98	211.46	220.19	278.13
RADAR ONLY	88.00	124.00	161.00	106.00	111.00	117.00
BEACON ONLY	12.00	23.00	35.00	5.00	9.00	13.00
DISCRETE	3.00	5.00	8.00	4.00	7.00	10.00
NON DISCRETE	9.00	18.00	27.00	1.00	2.00	3.00
MODE C	7.00	13.00	20.00	4.00	7.00	10.00
RADAR REINFORCED BEACON	138.20	267.59	396.98	100.46	100.19	148.13
DISCRETE	70.02	70.02	86.66	93.35	93.35	113.65
NON DISCRETE	68.18	197.57	310.32	7.10	6.83	34.48
MODE C	79.09	152.61	226.12	93.35	93.35	113.46
ASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		30			40	
RADAR ONLY		1			2	
BEACON ONLY		2			3	
DISCRETE		2			3	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		27			35	
DISCRETE		25			33	
NON DISCRETE		2			2	
MODE C		27			36	
UNASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	154	327	499	72	76	131
RADAR ONLY	39	76	114	6	10	15
BEACON ONLY	4	10	15	1	1	3
DISCRETE	1	1	2	1	1	2
NON DISCRETE	3	9	13	0	0	1
MODE C	2	6	9	3	3	4
RADAR REINFORCED BEACON	111	241	370	65	65	113
DISCRETE	45	45	62	63	60	81
NON DISCRETE	56	196	308	5	5	32
MODE C	52	126	199	57	57	77
CROSS-LINKED		54			70	
UNUSED TARGET REPORTS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	55	62	67	104	104	106
BEACON	53	53	50	100	100	100
	6	12	17	4	4	6

SYSTEM LOAD VALUES

FDD

NEW YORK JFK

1990

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	189.06	362.83	536.54	117.86	120.86	175.03
RADAR ONLY	31.54	50.58	89.82	3.22	6.21	9.21
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	157.52	302.17	446.72	114.64	114.64	165.82
DISCRETE	32.51	92.51	98.59	110.01	110.01	126.32
NON DISCRETE	75.02	219.61	348.12	4.63	4.63	39.50
MODE C	94.45	180.76	267.08	110.01	110.01	128.98
ADJUSTED						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	244.92	421.95	600.98	215.47	224.47	280.56
RADAR ONLY	97.00	120.00	154.00	105.00	110.00	115.00
BEACON ONLY	13.00	24.00	36.00	5.00	9.00	13.00
DISCRETE	3.00	5.00	8.00	4.00	7.00	10.00
NON DISCRETE	10.00	19.00	28.00	1.00	2.00	3.00
MODE C	9.00	14.00	21.00	4.00	7.00	10.00
RADAR REINFORCED BEACON	144.92	277.95	410.98	105.47	105.47	152.56
DISCRETE	75.91	75.91	90.71	101.21	101.21	116.22
NON DISCRETE	69.01	202.04	320.27	4.26	4.26	36.34
MODE C	86.90	166.30	245.71	101.21	101.21	118.66
ASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		31			41	
RADAR ONLY		1			2	
BEACON ONLY		2			3	
DISCRETE		2			3	
NON DISCRETE		0			0	
MODE C		1			2	
RADAR REINFORCED BEACON		28			36	
DISCRETE		27			35	
NON DISCRETE		1			1	
MODE C		29			39	
UNASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	158	332	506	76	79	134
RADAR ONLY	37	72	107	6	9	14
BEACON ONLY	4	10	16	1	1	4
DISCRETE	1	1	2	1	1	2
NON DISCRETE	3	9	14	0	0	2
MODE C	3	6	10	2	2	3
RADAR REINFORCED BEACON	117	250	383	69	69	115
DISCRETE	49	49	64	66	66	81
NON DISCRETE	58	201	319	3	3	35
MODE C	58	137	217	62	62	80
CROSS-LINKED		54			72	
UNUSED TARGET REPORTS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	56	62	68	105	105	107
RADAR	50	50	50	100	100	100
BEACON	5	12	18	5	5	7

SYSTEM LOAD VALUES

FOR
NEW YORK EWR
1977

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	97.35	206.99	316.63	79.46	83.61	121.84
RADAR ONLY	24.38	54.25	83.72	3.61	7.76	11.91
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	72.97	152.93	232.89	75.85	75.85	109.93
DISCRETE	44.91	44.91	67.01	59.88	59.88	90.30
NON DISCRETE	28.06	108.02	165.88	15.97	15.97	19.62
MODE C	44.91	74.74	111.80	59.88	59.88	83.38

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	149.13	260.69	373.26	177.78	185.78	226.13
RADAR ONLY	76.00	108.30	140.00	105.00	110.00	116.00
BEACON ONLY	6.00	12.00	19.00	3.00	6.00	9.00
DISCRETE	2.00	4.00	5.00	3.00	5.00	7.00
NON DISCRETE	4.00	8.00	14.00	0.00	1.00	2.00
MODE C	3.00	6.00	9.00	2.00	5.00	7.00
RADAR REINFORCED BEACON	67.13	140.69	214.26	69.78	69.78	101.13
DISCRETE	41.32	41.32	61.65	55.09	55.09	83.08
NON DISCRETE	25.81	99.38	152.61	14.69	14.69	18.05
MODE C	41.32	68.77	102.85	55.09	55.09	76.71

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		21			28	
RADAR ONLY		2			2	
BEACON ONLY		1			2	
DISCRETE		1			2	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		18			24	
DISCRETE		14			19	
NON DISCRETE		4			5	
MODE C		16			21	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	76	185	297	52	56	94
RADAR ONLY	25	58	91	5	9	14
BEACON ONLY	2	5	9	1	1	3
DISCRETE	1	1	2	0	0	2
NON DISCRETE	1	4	7	1	1	1
MODE C	1	2	3	1	1	2
RADAR REINFORCED BEACON	49	122	197	46	46	77
DISCRETE	27	27	48	36	36	64
NON DISCRETE	22	95	149	10	10	13
MODE C	25	53	87	34	34	56
CROSS-LINKED		36			45	

UNUSED TARGET REPORTS						
RADAR	53	56	59	103	103	104
BEACON	3	6	9	3	3	4

SYSTEM LOAD VALUES

FOP

NEW YORK EWR

1980

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	106.28	223.55	340.82	93.81	97.60	128.97
RADAR ONLY	25.19	54.47	83.76	3.43	7.22	11.01
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.10	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	91.10	169.08	257.06	90.38	90.38	117.96
DISCRETE	56.48	56.48	69.51	75.31	75.31	96.15
NON DISCRETE	24.62	112.60	187.55	15.06	15.06	21.81
MODE C	56.48	88.45	133.07	75.31	75.31	90.17

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	157.61	278.55	398.49	191.15	199.15	232.52
RADAR ONLY	77.00	109.00	141.00	105.00	110.00	115.00
BEACON ONLY	6.00	14.00	21.00	3.00	6.00	9.00
DISCRETE	2.00	4.00	6.00	3.00	5.00	8.00
NON DISCRETE	4.00	10.00	15.00	0.00	1.00	1.00
MODE C	4.00	7.00	11.00	3.00	5.00	7.00
RADAR REINFORCED BEACON	74.61	155.55	236.49	93.15	83.15	108.52
DISCRETE	51.97	51.97	63.95	69.29	69.29	88.46
NON DISCRETE	22.65	103.59	172.55	13.86	13.86	20.06
MODE C	51.97	81.37	122.43	69.29	69.29	82.96

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		26			34	
RADAR ONLY		2			3	
BEACON ONLY		2			2	
DISCRETE		2			2	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		22			29	
DISCRETE		18			24	
NON DISCRETE		4			5	
MODE C		20			26	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	80	198	316	50	64	95
RADAR ONLY	26	59	92	4	8	13
BEACON ONLY	1	5	9	2	2	3
DISCRETE	0	0	1	1	1	2
NON DISCRETE	1	5	8	1	1	1
MODE C	1	3	4	2	2	3
RADAR REINFORCED BEACON	53	134	215	54	54	79
DISCRETE	34	34	46	45	45	64
NON DISCRETE	19	100	169	9	9	15
MODE C	32	61	102	43	43	57
CROSS-LINKED		43			54	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	53	57	60	104	104	105
RADAR	50	50	50	100	100	100
BEACON	3	7	10	4	4	5

SYSTEM LOAD VALUES

FOR
NEW YORK EWR
1982

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	111.35	232.33	352.70	98.97	102.50	133.50
RADAR ONLY	24.09	51.42	78.75	3.28	6.81	10.34
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	87.26	180.61	273.95	95.69	95.69	123.16
DISCRETE	61.41	61.41	73.79	81.88	81.88	99.99
NON DISCRETE	25.85	119.19	200.16	13.81	13.81	23.17
MODE C	61.41	98.50	148.26	81.88	81.88	95.58

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	164.28	287.16	411.04	196.04	205.04	238.31
RADAR ONLY	77.00	137.00	137.00	105.00	110.00	115.00
BEACON ONLY	7.00	14.00	22.00	3.00	7.00	10.00
DISCRETE	2.00	4.00	6.00	3.00	5.00	8.00
NON DISCRETE	5.00	10.00	16.00	0.00	2.00	2.00
MODE C	4.00	8.00	12.00	3.00	5.00	8.00
RADAR REINFORCED BEACON	80.28	166.16	252.04	88.04	88.04	113.31
DISCRETE	56.50	56.50	67.88	75.33	75.33	91.99
NON DISCRETE	23.78	109.66	184.15	12.71	12.71	21.32
MODE C	56.50	90.71	136.49	75.33	75.33	87.94

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		27			34	
RADAR ONLY		2			2	
BEACON ONLY		2			2	
DISCRETE		2			2	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		23			30	
DISCRETE		20			26	
NON DISCRETE		3			4	
MODE C		21			29	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	84	235	326	65	69	99
RADAR ONLY	26	57	88	5	9	13
BEACON ONLY	1	5	9	2	2	3
DISCRETE	0	0	1	1	1	2
NON DISCRETE	1	5	8	1	1	1
MODE C	1	3	5	2	2	3
RADAR REINFORCED BEACON	57	143	229	58	58	83
DISCRETE	36	36	48	49	49	66
NON DISCRETE	21	137	181	9	9	17
MODE C	35	70	115	46	46	59
CROSS-LINKED		43			56	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	53	57	61	104	104	105
RADAR	50	50	50	100	100	100
BEACON	3	7	11	4	4	5

SYSTEM LOAD VALUES

FOR
NEW YORK EWR
1984

PAGE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	116.29	239.43	362.57	102.57	105.77	156.96
RADAR ONLY	23.60	49.55	75.52	3.76	6.26	9.46
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	92.69	189.87	287.05	99.51	99.51	127.50
DISCRETE	65.49	55.49	78.01	87.32	87.32	103.26
NON DISCRETE	27.20	124.38	209.04	12.18	12.18	24.24
MODE C	65.49	107.04	160.83	87.32	87.32	99.99

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	168.28	294.68	421.08	179.55	207.55	241.30
RADAR ONLY	76.00	135.00	134.00	105.00	109.00	114.00
BEACON ONLY	7.00	15.00	23.00	3.00	7.00	10.00
DISCRETE	2.00	4.00	6.00	3.00	6.00	8.00
NON DISCRETE	5.00	11.00	17.00	0.00	1.00	2.00
MODE C	4.00	9.00	13.00	3.00	5.00	8.00
RADAR REINFORCED BEACON	85.28	174.68	264.04	91.55	91.55	117.30
DISCRETE	60.25	60.25	71.77	80.34	80.34	95.00
NON DISCRETE	25.02	114.43	192.32	11.21	11.21	22.30
MODE C	60.25	98.48	147.97	80.34	80.34	91.99

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		28			36	
RADAR ONLY		2			2	
BEACON ONLY		2			2	
DISCRETE		2			2	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		24			32	
DISCRETE		21			28	
NON DISCRETE		3			4	
MODE C		23			31	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	88	211	334	65	68	101
RADAR ONLY	25	55	85	5	8	13
BEACON ONLY	2	6	9	1	1	3
DISCRETE	1	1	1	1	1	2
NON DISCRETE	1	5	8	0	0	1
MODE C	2	3	5	2	2	3
RADAR REINFORCED BEACON	61	150	240	59	59	85
DISCRETE	39	39	51	52	52	67
NON DISCRETE	22	111	189	7	7	18
MODE C	37	75	125	49	49	61
CROSS-LINKED		45			59	

UNUSED TARGET REPORTS						
	A	B	C	A	B	C
RADAR	54	58	61	104	104	105
BEACON	50	50	50	100	100	100
	4	8	11	4	4	5

SYSTEM LOAD VALUES

FOR

NEW YORK EWR

1986

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	120.29	245.29	270.29	105.74	109.58	137.25
RADAR ONLY	22.76	47.20	71.65	2.79	5.63	8.48
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	97.53	198.09	298.65	103.94	103.94	130.78
DISCRETE	70.09	70.08	81.64	93.44	93.44	105.61
NON DISCRETE	27.45	128.01	217.00	10.50	10.50	25.16
MODE C	70.08	116.90	175.42	93.44	93.44	104.13

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	173.73	301.24	429.75	203.53	211.63	243.31
RADAR ONLY	76.00	103.00	131.00	104.00	109.00	113.00
BEACON ONLY	8.00	16.00	24.00	4.00	7.00	10.00
DISCRETE	2.00	4.00	7.00	3.00	6.00	8.00
NON DISCRETE	6.00	12.00	17.00	1.00	1.00	2.00
MODE C	5.00	9.00	14.00	3.00	6.00	8.00
RADAR REINFORCED BEACON	89.73	182.24	274.75	95.63	95.63	120.31
DISCRETE	64.43	64.48	75.11	85.97	85.97	97.16
NON DISCRETE	25.25	117.77	199.64	9.66	9.66	23.15
MODE C	64.48	107.55	161.38	95.97	95.97	95.00

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		29			38	
RADAR ONLY		1			2	
BEACON ONLY		2			3	
DISCRETE		2			3	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		26			33	
DISCRETE		23			30	
NON DISCRETE		3			3	
MODE C		25			33	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	91	216	342	49	72	101
RADAR ONLY	26	54	83	5	3	12
BEACON ONLY	2	6	10	1	1	2
DISCRETE	1	1	1	1	1	1
NON DISCRETE	1	5	9	0	0	1
MODE C	2	4	6	3	3	3
RADAR REINFORCED BEACON	63	156	249	53	63	97
DISCRETE	41	41	52	56	56	67
NON DISCRETE	22	115	197	7	7	20
MODE C	39	83	136	53	53	63
CROSS-LINKED		48			61	
UNUSED TARGET REPORTS	54	58	62	104	104	105
RADAR	50	50	50	100	100	100
BEACON	4	8	12	4	4	5

SYSTEM LOAD VALUES

FOR

NEW YORK EWR

1988

94SE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	124.19	250.37	376.95	111.69	114.17	141.83
RADAR ONLY	20.77	42.54	64.31	2.50	4.98	7.45
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	103.43	208.33	312.64	109.19	109.19	134.34
DISCRETE	76.10	76.10	89.82	101.47	101.47	101.47
NON DISCRETE	27.32	131.93	226.82	7.72	7.72	32.87
MODE C	76.10	126.83	189.87	101.47	101.47	101.47

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	177.15	307.39	436.63	208.46	215.46	247.63
RADAR ONLY	74.00	99.00	124.00	104.00	108.00	113.00
BEACON ONLY	8.00	17.00	25.00	4.00	7.00	11.00
DISCRETE	2.00	5.00	7.00	3.00	6.00	9.00
NON DISCRETE	6.00	12.00	18.00	1.00	1.00	2.00
MODE C	5.00	10.00	15.00	3.00	6.00	9.00
RADAR REINFORCED BEACON	95.15	191.39	287.63	100.46	100.46	123.63
DISCRETE	70.02	70.02	78.95	93.35	93.35	93.35
NON DISCRETE	25.14	121.38	208.68	7.10	7.10	30.24
MODE C	70.02	116.68	174.68	93.35	93.35	93.35

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		30			40	
RADAR ONLY		1			2	
BEACON ONLY		2			3	
DISCRETE		2			3	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		27			35	
DISCRETE		25			33	
NON DISCRETE		2			2	
MODE C		27			36	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	94	220	347	71	73	101
RADAR ONLY	24	50	76	5	7	11
BEACON ONLY	2	6	10	1	1	2
DISCRETE	1	1	1	1	1	1
NON DISCRETE	1	5	9	0	0	1
MODE C	2	4	7	3	3	3
RADAR REINFORCED BEACON	68	164	261	65	65	88
DISCRETE	45	45	54	60	60	60
NON DISCRETE	23	119	207	5	5	28
MODE C	43	90	148	57	57	57
CROSS-LINKED		50			65	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	54	98	63	104	104	105
BEACON	50	50	50	100	100	100
	4	8	13	4	4	5

SYSTEM LOAD VALUES

FOR
NEW YORK EWR
1990

USE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	128.06	255.59	383.11	116.92	118.92	144.54
ADAP ONLY	19.52	39.51	59.49	2.17	4.28	6.39
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
ADAP REINFORCED BEACON	108.54	216.08	323.61	114.64	114.64	138.16
DISCRETE	82.51	82.51	89.57	110.01	110.01	110.01
NON DISCRETE	26.03	133.57	234.05	4.63	4.63	28.15
MODE C	82.51	137.06	204.63	110.01	110.01	110.01
ADJUSTED						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	181.86	312.79	443.73	213.47	220.47	250.11
ADAP ONLY	73.00	97.00	120.00	104.00	108.00	112.00
BEACON ONLY	9.00	17.00	26.00	4.00	7.00	11.00
DISCRETE	3.00	5.00	7.00	3.00	6.00	9.00
NON DISCRETE	6.00	12.00	19.00	1.00	1.00	2.00
MODE C	5.00	11.00	16.00	3.00	6.00	9.00
ADAP REINFORCED BEACON	99.86	198.79	297.73	105.47	105.47	127.11
DISCRETE	75.91	75.91	82.40	101.21	101.21	101.21
NON DISCRETE	23.95	122.88	215.32	4.26	4.26	25.90
MODE C	75.91	126.10	188.26	101.21	101.21	101.21
ASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		31			41	
ADAP ONLY		1			2	
BEACON ONLY		2			3	
DISCRETE		2			3	
NON DISCRETE		0			0	
MODE C		1			2	
ADAP REINFORCED BEACON		28			36	
DISCRETE		27			35	
NON DISCRETE		1			1	
MODE C		29			39	
UNASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	97	224	351	75	77	103
ADAP ONLY	23	47	71	5	7	10
BEACON ONLY	2	6	11	1	1	2
DISCRETE	1	1	2	1	1	1
NON DISCRETE	1	5	9	0	0	1
MODE C	2	4	7	2	2	2
ADAP REINFORCED BEACON	72	171	269	69	69	91
DISCRETE	49	49	55	66	66	66
NON DISCRETE	23	122	214	3	3	25
MODE C	47	97	159	52	62	62
POSS-LINKED		50			67	
UNUSED TARGET REPORTS						
	A	B	C	A	B	C
ADAP	50	50	50	100	100	100
BEACON	4	9	13	5	5	6

SYSTEM LOAD VALUES FOR NEW YORK HPN 1977						
BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	95.81	200.77	305.74	79.96	84.60	114.25
RADAR ONLY	25.65	55.86	86.07	4.10	8.75	13.39
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	70.15	144.91	219.67	75.85	75.85	100.86
DISCRETE	44.91	44.91	56.41	59.88	59.88	79.43
NON DISCRETE	25.24	100.00	163.26	15.97	15.97	21.46
MODE C	44.91	64.44	95.71	59.88	59.88	71.48
ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	147.54	254.32	361.10	177.78	185.78	217.80
RADAR ONLY	77.00	109.00	141.00	105.00	111.00	117.00
BEACON ONLY	6.00	12.00	18.00	3.00	5.00	8.00
DISCRETE	2.00	3.00	5.00	2.00	4.00	6.00
NON DISCRETE	4.00	9.00	13.00	1.00	1.00	2.00
MODE C	3.00	5.00	8.00	2.00	4.00	6.00
RADAR REINFORCED BEACON	64.54	133.32	202.10	69.78	69.78	92.80
DISCRETE	41.32	41.32	51.90	55.09	55.09	73.05
NON DISCRETE	23.22	92.00	150.20	14.69	14.69	19.75
MODE C	41.32	59.29	88.06	55.09	55.09	65.76
ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		10			12	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		0			0	
RADAR REINFORCED BEACON		8			10	
DISCRETE		6			8	
NON DISCRETE		2			2	
MODE C		7			9	
UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	85	191	296	68	73	102
RADAR ONLY	27	61	94	6	11	16
BEACON ONLY	2	5	8	2	2	3
DISCRETE	1	1	1	1	1	2
NON DISCRETE	1	4	7	1	1	1
MODE C	2	3	4	2	2	3
RADAR REINFORCED BEACON	55	125	194	60	60	83
DISCRETE	35	35	46	47	47	65
NON DISCRETE	21	90	148	13	13	18
MODE C	34	52	81	46	46	57
CROSS-LINKED		46			60	
UNUSED TARGET REPORTS						
	A	B	C	A	B	C
RADAR	53	56	59	103	103	104
BEACON	3	4	9	3	3	4

SYSTEM LOAD VALUES

FOR
NEW YORK HON
1983

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	106.67	218.49	330.92	94.37	98.64	122.24
RADAR ONLY	26.85	56.51	86.38	4.30	8.26	12.53
BEACON ONLY	0.00	0.30	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.30	0.00	0.30	0.00	0.00
NON DISCRETE	0.00	0.30	0.00	0.00	0.30	0.00
MODE C	0.00	0.30	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	79.22	161.88	244.53	90.38	90.38	109.72
DISCRETE	56.48	56.48	56.48	75.31	75.31	65.48
NON DISCRETE	22.74	105.39	188.05	15.06	15.06	24.24
MODE C	56.48	78.30	117.02	75.31	75.31	75.31
ADJUSTED						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	157.89	272.93	387.97	191.15	200.15	225.94
RADAR ONLY	79.03	111.00	143.00	105.00	111.00	116.00
BEACON ONLY	6.00	13.30	20.00	3.30	6.00	9.00
DISCRETE	2.00	3.00	5.00	2.00	5.00	7.00
NON DISCRETE	4.00	10.30	15.00	1.30	1.00	2.30
MODE C	3.00	5.30	9.00	2.00	4.00	6.30
RADAR REINFORCED BEACON	72.89	148.93	224.97	83.15	83.15	100.94
DISCRETE	51.97	51.97	51.97	69.29	69.29	78.64
NON DISCRETE	20.92	96.96	173.00	13.86	13.86	22.30
MODE C	51.97	72.04	107.65	69.29	69.29	69.29
ASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		12			14	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		0			0	
RADAR REINFORCED BEACON		10			12	
DISCRETE		9			10	
NON DISCRETE		2			2	
MODE C		8			11	
UNASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	94	206	319	91	85	108
RADAR ONLY	29	62	95	7	11	16
BEACON ONLY	2	5	9	3	3	3
DISCRETE	1	1	1	2	2	2
NON DISCRETE	1	4	8	1	1	1
MODE C	2	3	5	3	3	3
RADAR REINFORCED BEACON	63	139	215	71	71	89
DISCRETE	44	44	44	59	59	69
NON DISCRETE	19	95	171	12	12	20
MODE C	44	64	100	58	58	58
CROSS-LINKED		57			73	
UNUSED TARGET REPORTS						
	A	B	C	A	B	C
RADAR	53	55	60	104	104	104
BEACON	3	6	10	4	4	4

SYSTEM LOAD VALUES

FOR

NEW YORK HBN

1982

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	112.32	228.26	344.23	99.57	103.56	127.33
RADAR ONLY	26.00	53.81	81.62	3.87	7.87	11.86
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	86.32	174.46	262.59	95.69	95.69	115.47
DISCRETE	61.41	61.41	61.41	81.88	81.88	89.45
NON DISCRETE	24.91	113.04	201.17	13.81	13.81	25.02
MODE C	61.41	88.80	132.67	81.88	81.88	81.88
ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	164.42	283.50	401.58	196.04	205.04	231.23
RADAR ONLY	78.00	109.00	139.00	105.00	111.00	116.00
BEACON ONLY	7.00	14.00	21.00	3.00	6.00	9.00
DISCRETE	2.00	3.00	5.00	3.00	5.00	7.00
NON DISCRETE	5.00	11.00	16.00	0.00	1.00	2.00
MODE C	4.00	7.00	11.00	2.00	5.00	7.00
RADAR REINFORCED BEACON	79.42	160.50	241.58	88.04	88.04	106.23
DISCRETE	56.50	56.50	56.50	75.33	75.33	82.30
NON DISCRETE	22.92	104.00	185.08	12.71	12.71	23.93
MODE C	56.50	81.70	122.05	75.33	75.33	75.33
ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		11			15	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		0			1	
RADAR REINFORCED BEACON		9			13	
DISCRETE		8			11	
NON DISCRETE		1			2	
MODE C		9			12	
UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	100	217	332	95	89	112
RADAR ONLY	28	60	91	7	11	15
BEACON ONLY	2	6	9	3	3	4
DISCRETE	1	1	1	2	2	3
NON DISCRETE	1	5	8	1	1	1
MODE C	2	4	5	2	2	2
RADAR REINFORCED BEACON	70	151	232	75	75	93
DISCRETE	48	48	48	64	64	71
NON DISCRETE	22	103	184	11	11	22
MODE C	47	73	113	63	63	63
CROSS-LINKED		58			74	
UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	53	57	61	104	104	105
BEACON	3	7	11	4	4	5

SYSTEM LOAD VALUES

FOR
NEW YORK HPN
1984

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	118.25	236.80	355.35	103.16	106.79	131.45
RADAR ONLY	25.65	52.10	78.53	3.66	7.29	10.92
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	92.59	184.70	276.82	99.51	99.51	120.53
DISCRETE	65.49	65.49	65.49	87.32	87.32	87.32
NON DISCRETE	27.10	119.21	211.33	12.18	12.18	33.21
MODE C	65.49	97.72	145.71	87.32	87.32	87.32
ADJUSTED						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	170.19	291.93	412.67	199.55	208.55	235.89
RADAR ONLY	78.00	107.00	136.00	105.00	110.00	115.00
BEACON ONLY	7.00	15.00	22.00	3.00	7.00	10.00
DISCRETE	2.00	4.00	5.00	3.00	5.00	7.00
NON DISCRETE	5.00	11.00	17.00	0.00	2.00	3.00
MODE C	4.00	8.00	12.00	3.00	5.00	7.00
RADAR REINFORCED BEACON	85.19	169.93	254.67	91.55	91.55	110.89
DISCRETE	60.25	60.25	60.25	80.34	80.34	80.34
NON DISCRETE	24.93	109.68	194.42	11.21	11.21	30.56
MODE C	60.25	89.93	134.05	80.34	80.34	80.34
ASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		12			16	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		0			1	
RADAR REINFORCED BEACON		10			14	
DISCRETE		9			12	
NON DISCRETE		1			2	
MODE C		10			13	
UNASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	106	225	343	86	89	115
RADAR ONLY	28	58	89	7	10	15
BEACON ONLY	3	7	10	2	2	3
DISCRETE	2	2	2	2	2	2
NON DISCRETE	1	5	8	0	0	1
MODE C	3	4	6	2	2	2
RADAR REINFORCED BEACON	75	160	244	77	77	97
DISCRETE	31	51	51	68	68	68
NON DISCRETE	24	109	193	9	9	29
MODE C	33	80	124	67	67	67
CROSS-LINKED		60			78	
UNUSED TARGET REPORTS						
	A	B	C	A	B	C
RADAR	54	57	61	134	104	105
BEACON	50	50	50	100	100	100
	4	7	11	4	4	5

SYSTEM LOAD VALUES

FOR
NEW YORK HPN
1986

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	123.14	243.53	363.92	107.31	110.55	134.25
RADAR ONLY	24.93	49.81	74.62	3.37	6.60	9.84
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	98.22	193.72	289.22	103.94	103.94	124.32
DISCRETE	70.08	70.08	70.08	93.44	93.44	93.44
NON DISCRETE	28.13	123.64	219.14	10.50	10.50	30.88
MODE C	70.08	108.04	160.75	93.44	93.44	93.44

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	175.36	300.22	422.08	204.63	212.63	238.24
RADAR ONLY	78.00	106.00	133.00	105.00	110.00	114.00
BEACON ONLY	8.00	16.00	23.00	4.00	7.00	10.00
DISCRETE	2.00	4.00	6.00	3.00	5.00	8.00
NON DISCRETE	6.00	12.00	17.00	1.00	2.00	3.00
MODE C	4.00	9.00	13.00	3.00	5.00	7.00
RADAR REINFORCED BEACON	90.36	178.22	266.08	95.63	95.63	114.39
DISCRETE	64.48	64.48	64.48	85.97	85.97	85.97
NON DISCRETE	25.88	113.74	201.61	9.66	9.66	28.42
MODE C	64.48	99.40	147.89	85.97	85.97	85.97

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		13			16	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		0			1	
RADAR REINFORCED BEACON		11			14	
DISCRETE		10			13	
NON DISCRETE		1			1	
MODE C		11			14	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	110	231	351	92	95	119
RADAR ONLY	28	57	85	7	10	14
BEACON ONLY	3	7	11	3	3	4
DISCRETE	2	2	2	3	3	3
NON DISCRETE	1	5	9	0	0	1
MODE C	3	4	6	3	3	3
RADAR REINFORCED BEACON	79	167	255	82	82	100
DISCRETE	54	54	54	73	73	73
NON DISCRETE	25	113	201	9	9	27
MODE C	53	88	137	72	72	70
CROSS-LINKED		63			82	
UNUSED TARGET REPORTS	54	58	62	104	104	105
RADAR	50	50	50	100	100	100
BEACON	4	8	12	4	4	5

SYSTEM LOAD VALUES

FOR

NEW YORK WDN

1988

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	128.12	250.39	372.01	112.23	115.05	137.13
RADAR ONLY	22.94	45.15	67.35	3.33	5.86	8.69
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	105.18	204.95	304.71	109.19	109.19	128.42
DISCRETE	76.10	76.10	76.10	101.47	101.47	101.47
NON DISCRETE	29.07	128.84	228.61	7.72	7.72	26.94
MODE C	76.10	118.75	176.14	101.47	101.47	101.47
ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	180.76	306.55	431.34	209.46	216.46	241.14
RADAR ONLY	76.00	102.00	127.00	105.00	109.00	113.00
BEACON ONLY	8.00	16.00	24.00	4.00	7.00	10.00
DISCRETE	2.00	4.00	6.00	3.00	5.00	8.00
NON DISCRETE	6.00	12.00	18.00	1.00	2.00	2.00
MODE C	5.00	10.00	14.00	3.00	5.00	8.00
RADAR REINFORCED BEACON	96.76	188.55	280.34	100.46	100.46	118.14
DISCRETE	70.02	70.02	70.02	93.35	93.35	93.35
NON DISCRETE	26.75	118.54	210.32	7.10	7.10	24.79
MODE C	70.02	109.25	162.64	93.35	93.35	93.35
ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		14			17	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		0			1	
RADAR REINFORCED BEACON		12			15	
DISCRETE		11			14	
NON DISCRETE		1			1	
MODE C		11			15	
UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	114	236	358	94	97	120
RADAR ONLY	26	52	79	6	9	13
BEACON ONLY	3	7	11	3	3	4
DISCRETE	2	2	2	3	3	3
NON DISCRETE	1	5	9	0	0	1
MODE C	3	5	7	3	3	3
RADAR REINFORCED BEACON	85	177	258	85	85	103
DISCRETE	59	59	59	79	79	79
NON DISCRETE	26	118	209	6	6	24
MODE C	59	98	151	78	78	78
CROSS-LINKED		66			86	
UNUSED TARGET REPORTS	54	58	62	104	104	105
RADAR	50	50	50	100	100	100
BEACON	4	8	12	4	4	5

SYSTEM LOAD VALUES
FOR
NEW YORK MPN
1990

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	132.75	256.00	379.24	117.30	119.71	140.12
RADAR ONLY	21.70	42.11	62.52	2.66	5.36	7.47
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	111.06	213.89	316.71	114.64	114.64	132.65
DISCRETE	82.51	82.51	82.51	110.01	110.01	110.01
NON DISCRETE	28.55	131.38	234.20	4.63	4.63	22.64
MODE C	82.51	129.66	191.66	110.01	110.01	110.01
ADJUSTED						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	186.18	312.79	439.37	213.47	220.47	243.04
RADAR ONLY	75.00	99.00	123.00	104.00	108.00	112.00
BEACON ONLY	9.00	17.00	25.00	4.00	7.00	11.00
DISCRETE	2.00	4.00	6.00	3.00	5.00	8.00
NON DISCRETE	7.00	13.00	19.00	1.00	2.00	3.00
MODE C	5.00	10.00	15.00	3.00	6.00	8.00
RADAR REINFORCED BEACON	102.18	196.78	291.37	105.47	105.47	122.04
DISCRETE	75.91	75.91	75.91	101.21	101.21	101.21
NON DISCRETE	26.27	120.87	215.47	4.26	4.26	20.83
MODE C	75.91	119.29	176.33	101.21	101.21	101.21
ASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		13			18	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		0			1	
RADAR REINFORCED BEACON		11			16	
DISCRETE		11			15	
NON DISCRETE		0			1	
MODE C		12			17	
UNASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	119	243	365	98	101	122
RADAR ONLY	25	50	74	6	9	12
BEACON ONLY	3	7	11	3	3	4
DISCRETE	2	2	2	3	3	3
NON DISCRETE	1	5	9	0	0	1
MODE C	3	5	8	3	3	3
RADAR REINFORCED BEACON	91	196	280	89	89	106
DISCRETE	65	65	65	86	86	86
NON DISCRETE	26	121	215	3	3	20
MODE C	64	107	164	84	84	84
CROSS-LINKED		67			89	
UNUSED TARGET REPORTS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	54	59	63	105	105	105
RADAR	50	50	50	100	100	100
BEACON	4	9	13	5	5	5

SYSTEM LOAD VALUES

FOR

NEW YORK ISP

1977

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	123.46	252.69	381.92	80.59	85.93	117.33
RADAR ONLY	35.91	74.89	113.87	4.84	10.08	15.32
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	87.55	177.80	268.05	75.85	75.85	102.01
DISCRETE	44.91	44.91	52.08	59.88	59.88	77.67
NON DISCRETE	42.64	132.89	215.97	15.97	15.97	24.34
MODE C	44.91	70.07	104.25	59.88	59.88	68.49

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	175.55	306.58	437.60	178.78	186.78	220.85
RADAR ONLY	98.00	129.00	170.00	106.00	112.00	119.00
BEACON ONLY	7.00	14.00	21.00	3.00	5.00	8.00
DISCRETE	2.00	3.00	4.00	2.00	4.00	6.00
NON DISCRETE	5.00	11.00	17.00	1.00	1.00	2.00
MODE C	3.00	5.00	8.00	2.00	4.00	5.00
RADAR REINFORCED BEACON	80.55	163.58	246.60	69.78	69.78	93.85
DISCRETE	41.32	41.32	47.92	55.09	55.09	71.46
NON DISCRETE	39.23	122.26	198.69	14.69	14.69	22.39
MODE C	41.32	64.47	95.91	55.09	55.09	63.61

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		10			12	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		0			0	
RADAR REINFORCED BEACON		9			10	
DISCRETE		5			8	
NON DISCRETE		2			2	
MODE C		7			9	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	113	242	373	69	74	104
RADAR ONLY	38	81	124	7	12	18
BEACON ONLY	3	6	10	2	2	3
DISCRETE	1	1	1	1	1	2
NON DISCRETE	2	5	9	1	1	1
MODE C	2	3	4	2	2	3
RADAR REINFORCED BEACON	72	155	239	60	60	83
DISCRETE	35	35	42	47	47	63
NON DISCRETE	37	120	197	13	13	20
MODE C	34	57	89	46	46	54
CROSS-LINKED		39			51	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	54	57	61	103	103	104
RADAR	50	50	50	100	100	100
BEACON	4	7	11	3	3	4

SYSTEM LOAD VALUES

FOR
NEW YORK ISP
1980

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	139.63	276.23	412.84	95.15	99.93	126.43
RADAR ONLY	38.03	75.84	113.65	4.78	9.56	14.33
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	121.59	200.39	299.19	90.38	90.38	112.09
DISCRETE	56.48	56.48	56.48	75.31	75.31	84.50
NON DISCRETE	45.11	143.91	242.71	15.06	15.06	27.59
MODE C	56.48	88.53	131.55	75.31	75.31	75.31
ADJUSTED						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	192.47	331.36	470.26	192.15	201.15	230.12
RADAR ONLY	91.00	131.00	171.00	106.00	112.00	118.00
BEACON ONLY	8.00	16.00	24.00	3.00	6.00	9.00
DISCRETE	2.00	3.00	4.00	2.00	5.00	7.00
NON DISCRETE	6.00	13.00	20.00	1.00	1.00	2.00
MODE C	4.00	7.00	11.00	2.00	4.00	6.00
RADAR REINFORCED BEACON	93.47	184.36	275.26	83.15	83.15	103.12
DISCRETE	51.97	51.97	51.97	69.29	69.29	77.74
NON DISCRETE	41.50	132.40	223.29	13.86	13.86	25.38
MODE C	51.97	91.44	121.03	59.29	69.29	69.29
ASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		12			14	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		0			0	
RADAR REINFORCED BEACON		10			12	
DISCRETE		8			10	
NON DISCRETE		2			2	
MODE C		8			11	
UNASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	128	264	401	91	86	112
RADAR ONLY	41	83	125	7	12	18
BEACON ONLY	3	7	11	3	3	3
DISCRETE	1	1	1	2	2	2
NON DISCRETE	2	6	10	1	1	1
MODE C	2	4	5	3	3	3
RADAR REINFORCED BEACON	84	174	265	71	71	91
DISCRETE	44	44	44	59	59	68
NON DISCRETE	40	130	221	12	12	23
MODE C	44	73	113	58	58	58
CROSS-LINKED		48			62	
UNUSED TARGET REPORTS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	54	58	62	104	104	104
BEACON	50	50	50	100	100	100
	4	8	12	4	4	4

SYSTEM LOAD VALUES

FOR
NEW YORK ISD
1982

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	147.25	285.38	425.53	100.33	104.74	131.89
RADAR ONLY	36.49	71.26	106.04	4.61	9.05	13.49
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	113.77	215.12	319.47	95.69	95.69	118.41
DISCRETE	61.41	61.41	61.41	81.88	81.88	88.86
NON DISCRETE	49.35	153.71	258.06	13.81	13.81	29.55
MODE C	61.41	101.74	150.75	81.88	81.88	81.88

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	199.91	341.91	494.91	197.04	206.64	235.94
RADAR ONLY	89.00	127.00	165.00	106.00	112.00	118.00
BEACON ONLY	9.00	17.00	26.00	3.00	6.00	9.00
DISCRETE	2.00	3.00	5.00	3.00	5.00	7.00
NON DISCRETE	7.00	14.00	21.00	0.00	1.00	2.00
MODE C	4.00	8.00	12.00	2.00	4.00	7.00
RADAR REINFORCED BEACON	101.91	197.91	293.91	88.04	88.04	108.94
DISCRETE	56.50	56.50	56.50	75.33	75.33	81.75
NON DISCRETE	45.41	141.41	237.41	12.71	12.71	27.18
MODE C	56.50	93.60	138.69	75.33	75.33	75.33

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		11			15	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		0			1	
RADAR REINFORCED BEACON		0			13	
DISCRETE		8			11	
NON DISCRETE		1			2	
MODE C		9			12	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	135	274	413	95	90	117
RADAR ONLY	40	79	118	7	12	17
BEACON ONLY	3	7	11	3	3	4
DISCRETE	1	1	1	2	2	3
NON DISCRETE	2	6	10	1	1	1
MODE C	2	4	6	2	2	2
RADAR REINFORCED BEACON	92	188	284	75	75	96
DISCRETE	48	48	48	54	64	71
NON DISCRETE	44	140	236	11	11	25
MODE C	47	85	130	53	63	63
CROSS-LINKED		49			63	

UNUSED TARGET REPORTS						
	A	B	C	A	B	C
RADAR	54	59	63	104	104	105
BEACON	50	50	50	100	100	100
	4	9	13	4	4	5

SYSTEM LOAD VALUES

FOR

NEW YORK IS*

1984

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	154.51	295.75	437.01	103.43	107.84	136.12
RADAR ONLY	35.75	68.52	101.30	4.33	8.33	12.34
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	118.76	227.23	335.71	99.51	99.51	123.78
DISCRETE	65.49	65.49	65.49	87.32	87.32	87.32
NON DISCRETE	53.27	161.74	270.22	12.18	12.18	36.45
MODE C	65.49	112.84	166.60	87.32	87.32	87.32

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	208.26	352.35	496.85	201.55	209.55	240.87
RADAR ONLY	89.00	125.00	161.00	106.00	111.00	117.00
BEACON ONLY	10.00	18.00	27.00	4.00	7.00	10.00
DISCRETE	2.00	3.00	5.00	3.00	5.00	7.00
NON DISCRETE	8.00	15.00	22.00	1.00	2.00	3.00
MODE C	5.00	9.00	13.00	3.00	5.00	7.00
RADAR REINFORCED BEACON	109.26	209.35	308.85	91.55	91.55	113.87
DISCRETE	60.25	60.25	60.25	80.34	80.34	80.34
NON DISCRETE	49.00	148.30	248.60	11.21	11.21	33.54
MODE C	60.25	103.81	153.27	80.34	80.34	80.34

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		12			16	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		0			1	
RADAR REINFORCED BEACON		10			14	
DISCRETE		9			12	
NON DISCRETE		1			2	
MODE C		10			13	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	142	284	426	86	90	119
RADAR ONLY	39	77	114	7	11	16
BEACON ONLY	4	8	13	2	2	3
DISCRETE	2	2	2	2	2	2
NON DISCRETE	2	6	11	0	0	1
MODE C	3	5	7	2	2	2
RADAR REINFORCED BEACON	99	199	299	77	77	100
DISCRETE	51	51	51	68	68	68
NON DISCRETE	48	148	248	9	9	32
MODE C	50	94	143	67	67	67
CROSS-LINKED		51			67	
UNUSED TARGET REPORTS	55	59	63	104	104	105
RADAR	50	50	50	100	100	100
BEACON	5	9	13	4	4	5

SYSTEM LOAD VALUES

FJR

NEW YORK ISO

1986

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	159.29	331.85	444.41	137.87	111.42	138.65
RADAR ONLY	34.22	64.81	95.41	3.93	7.47	11.02
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	125.07	237.03	349.00	103.94	103.94	127.63
DISCRETE	70.08	70.08	70.08	93.44	93.44	93.44
NON DISCRETE	54.99	166.95	278.91	10.50	10.50	34.19
MODE C	70.08	125.56	184.89	93.44	93.44	93.44

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	213.06	359.07	505.08	205.63	213.63	243.42
RADAR ONLY	88.00	122.00	156.00	106.00	111.00	116.00
BEACON ONLY	10.00	19.00	28.00	4.00	7.00	10.00
DISCRETE	2.00	4.00	5.00	3.00	5.00	8.00
NON DISCRETE	8.00	15.00	23.00	1.00	2.00	2.00
MODE C	5.00	10.00	15.00	3.00	5.00	7.00
RADAR REINFORCED BEACON	115.06	218.07	321.08	95.63	95.63	117.42
DISCRETE	64.48	64.48	64.48	85.97	85.97	85.97
NON DISCRETE	50.59	153.59	256.60	9.66	9.66	31.46
MODE C	64.48	115.51	170.10	85.97	85.97	85.97

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		13			16	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		0			1	
RADAR REINFORCED BEACON		11			14	
DISCRETE		10			13	
NON DISCRETE		1			1	
MODE C		11			14	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	146	289	431	92	96	122
RADAR ONLY	38	73	108	7	11	15
BEACON ONLY	4	9	13	3	3	4
DISCRETE	2	2	2	3	3	3
NON DISCRETE	2	7	11	0	0	1
MODE C	3	5	7	3	3	3
RADAR REINFORCED BEACON	104	207	310	82	82	103
DISCRETE	54	54	54	73	73	73
NON DISCRETE	50	153	256	9	9	30
MODE C	53	105	159	72	72	72
CROSS-LINKED		54			70	

UNUSED TARGET REPORTS						
	A	B	C	A	B	C
RADAR	50	50	50	100	100	100
BEACON	5	9	14	4	4	5

SYSTEM LOAD VALUES

FOR

NEW YORK ISP

1989

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	143.44	337.35	453.69	112.58	115.75	141.68
RADAR ONLY	30.89	57.95	95.03	3.48	6.55	9.62
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	132.54	249.11	365.68	109.10	109.19	132.06
DISCRETE	76.10	76.10	76.10	101.47	101.47	101.47
NON DISCRETE	56.44	173.01	289.58	7.72	7.72	30.59
MODE C	76.10	138.49	203.40	101.47	101.47	101.47

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	217.94	365.18	511.43	209.46	217.46	247.49
RADAR ONLY	85.00	116.00	146.00	105.00	110.00	115.00
BEACON ONLY	11.00	29.00	29.00	4.00	7.00	11.00
DISCRETE	2.00	4.00	6.00	3.00	5.00	8.00
NON DISCRETE	9.00	16.00	23.00	1.00	2.00	3.00
MODE C	6.00	11.00	16.00	3.00	5.00	9.00
RADAR REINFORCED BEACON	121.94	229.18	336.43	100.46	100.46	121.49
DISCRETE	70.02	70.02	70.02	93.35	93.35	93.35
NON DISCRETE	51.92	159.17	266.41	7.10	7.10	28.14
MODE C	70.02	127.41	187.13	93.35	93.35	93.35

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		14			17	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		0			1	
RADAR REINFORCED BEACON		12			15	
DISCRETE		11			14	
NON DISCRETE		1			1	
MODE C		11			15	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	143	293	437	95	98	124
RADAR ONLY	35	67	99	7	10	14
BEACON ONLY	4	9	14	3	3	4
DISCRETE	2	2	2	3	3	3
NON DISCRETE	2	7	12	0	0	1
MODE C	3	6	8	3	3	3
RADAR REINFORCED BEACON	110	217	324	95	85	106
DISCRETE	59	59	59	79	79	79
NON DISCRETE	51	158	265	6	6	27
MODE C	59	116	176	78	78	79
CROSS-LINKED		56			73	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	55	60	65	104	104	105
RADAR	50	50	50	100	100	100
BEACON	5	10	15	4	4	5

SYSTEM LOAD VALUES

FOR
NEW YORK ISP
1990

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	157.17	311.53	456.09	117.54	120.23	144.63
RADAR ONLY	28.72	53.41	78.10	3.00	5.59	8.19
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	138.46	259.23	377.99	114.54	114.64	136.42
DISCRETE	82.51	82.51	82.51	110.01	110.01	110.01
NON DISCRETE	55.95	175.72	295.49	4.63	4.63	26.41
MODE C	82.51	151.42	221.80	110.01	110.01	110.01

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	221.38	370.57	517.76	214.47	221.47	249.50
RADAR ONLY	83.00	112.00	140.00	105.00	109.00	113.00
BEACON ONLY	11.00	21.00	30.00	4.00	7.00	11.00
DISCRETE	2.00	4.00	6.00	3.00	6.00	8.00
NON DISCRETE	9.00	17.00	24.00	1.00	1.00	3.00
MODE C	6.00	12.00	18.00	3.00	6.00	8.00
RADAR REINFORCED BEACON	127.38	237.57	347.76	105.47	105.47	125.50
DISCRETE	75.91	75.91	75.91	101.21	101.21	101.21
NON DISCRETE	51.48	161.66	271.85	4.26	4.26	24.29
MODE C	75.91	139.30	204.06	101.21	101.21	101.21

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		13			18	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		0			1	
RADAR REINFORCED BEACON		11			16	
DISCRETE		11			15	
NON DISCRETE		0			1	
MODE C		12			17	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	153	299	443	90	101	126
RADAR ONLY	33	63	92	7	9	13
BEACON ONLY	4	9	14	3	3	4
DISCRETE	2	2	2	3	3	3
NON DISCRETE	2	7	12	0	0	1
MODE C	3	6	9	3	3	3
RADAR REINFORCED BEACON	116	227	337	89	89	109
DISCRETE	65	65	65	85	86	86
NON DISCRETE	51	162	272	3	3	23
MODE C	54	137	192	84	84	84
CROSS-LINKED		57			76	
UNUSED TARGET REPORTS	56	60	65	105	105	105
RADAR	50	50	50	100	100	100
BEACON	6	10	15	5	5	5

APPENDIX H

IAC SYSTEM LOAD FACTORS FOR THE
CHICAGO TRACON SURVEILLANCE SITES

SYSTEM LOAD VALUES
FOR
CHICAGO CHI-5
1977

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	80.28	172.80	265.32	69.39	73.12	76.84
RADAR ONLY	21.40	51.88	82.36	2.81	6.54	10.26
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	58.88	120.92	182.96	66.58	66.58	66.58
DISCRETE	39.42	39.42	39.42	52.56	52.56	52.56
NON DISCRETE	19.46	81.50	143.54	14.02	14.02	14.02
MODE C	39.42	46.43	64.78	52.56	52.56	52.56
ADJUSTED						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	132.17	226.25	319.32	167.26	173.26	178.26
RADAR ONLY	73.00	105.00	136.00	104.00	108.00	112.00
BEACON ONLY	5.00	10.00	15.00	2.00	4.00	5.00
DISCRETE	1.00	2.00	2.00	2.00	3.00	4.00
NON DISCRETE	4.00	8.00	13.00	0.00	1.00	1.00
MODE C	2.00	4.00	5.00	2.00	2.00	3.00
RADAR REINFORCED BEACON	94.17	111.25	168.32	61.26	61.26	61.26
DISCRETE	36.27	36.27	36.27	48.36	48.36	48.36
NON DISCRETE	17.90	74.98	132.05	12.90	12.90	12.90
MODE C	36.27	42.71	59.60	48.36	48.36	48.36
ASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		16			22	
RADAR ONLY		1			2	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		0			1	
RADAR REINFORCED BEACON		14			19	
DISCRETE		11			15	
NON DISCRETE		3			4	
MODE C		12			16	
UNASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	63	157	250	47	91	99
RADAR ONLY	23	56	89	3	7	11
BEACON ONLY	2	4	7	2	2	2
DISCRETE	1	1	1	1	1	1
NON DISCRETE	1	3	6	1	1	1
MODE C	2	2	3	1	1	1
RADAR REINFORCED BEACON	43	97	154	42	42	42
DISCRETE	23	23	23	33	33	33
NON DISCRETE	19	72	129	9	9	9
MODE C	24	31	48	32	32	32
CROSS-LINKED		36			48	
UNUSED TARGET REPORTS						
	A	B	C	A	B	C
RADAR	52	55	57	103	103	103
BEACON	2	5	7	3	3	3

SYSTEM LOAD VALUES

FOR

CHICAGO CHI-5

1980

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	91.63	193.41	295.19	70.94	74.25	79.33
RADAR ONLY	22.44	52.90	83.36	2.66	5.97	9.28
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	69.19	140.51	211.83	68.28	68.28	70.05
DISCRETE	42.67	42.67	42.67	56.90	56.90	56.90
NON DISCRETE	26.51	97.83	169.15	11.38	11.38	13.16
MODE C	42.67	62.55	89.04	56.90	56.90	56.90
ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	143.65	246.27	349.88	169.82	174.82	182.45
RADAR ONLY	74.00	106.00	138.00	105.00	108.00	112.00
BEACON ONLY	6.00	11.00	17.00	3.00	4.00	6.00
DISCRETE	2.00	2.00	3.00	2.00	3.00	4.00
NON DISCRETE	4.00	9.00	14.00	1.00	1.00	2.00
MODE C	3.00	5.00	7.00	2.00	3.00	4.00
RADAR REINFORCED BEACON	63.65	129.27	194.88	62.82	62.82	64.45
DISCRETE	39.26	39.26	39.26	52.35	52.35	52.35
NON DISCRETE	24.39	90.01	155.62	10.47	10.47	12.10
MODE C	39.26	57.55	81.92	52.35	52.35	52.35
ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		16			22	
RADAR ONLY		1			2	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		14			19	
DISCRETE		12			16	
NON DISCRETE		2			3	
MODE C		13			17	
UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	75	178	280	47	51	57
RADAR ONLY	24	58	91	3	7	10
BEACON ONLY	2	5	8	1	1	2
DISCRETE	1	1	1	1	1	1
NON DISCRETE	1	4	7	0	0	1
MODE C	1	2	3	1	1	1
RADAR REINFORCED BEACON	49	115	181	43	43	45
DISCRETE	27	27	27	36	36	36
NON DISCRETE	22	88	154	7	7	9
MODE C	26	45	69	35	35	35
CROSS-LINKED		35			49	
UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	53	56	58	103	103	103
BEACON	50	50	50	100	100	100
	3	6	8	3	3	3

SYSTEM LOAD VALUES

FOR

CHICAGO CHI-5

1982

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	96.10	201.23	306.35	72.53	75.59	82.04
RADAR ONLY	21.49	49.99	78.50	2.53	5.59	8.65
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	74.61	151.23	227.85	70.00	70.00	73.39
DISCRETE	44.92	44.92	44.92	59.89	59.89	59.89
NON DISCRETE	29.69	106.31	182.93	10.10	10.10	13.50
MODE C	44.92	71.75	103.10	59.89	59.89	59.89

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	148.64	255.13	361.63	171.40	175.40	184.52
RADAR ONLY	74.02	104.00	134.00	104.00	107.00	111.00
BEACON ONLY	6.00	12.00	18.00	3.00	4.00	6.00
DISCRETE	2.00	2.00	3.00	2.00	3.00	4.00
NON DISCRETE	4.00	10.00	15.00	1.00	1.00	2.00
MODE C	3.00	6.00	8.00	2.00	3.00	4.00
RADAR REINFORCED BEACON	68.64	139.13	209.63	64.40	64.40	67.52
DISCRETE	41.33	41.33	41.33	55.10	55.10	55.10
NON DISCRETE	27.31	97.81	168.30	9.29	9.29	12.42
MODE C	41.33	66.01	94.85	55.10	55.10	55.10

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		16			12	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		14			20	
DISCRETE		12			17	
NON DISCRETE		2			3	
MODE C		13			18	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	79	185	290	49	52	60
RADAR ONLY	23	55	87	4	7	11
BEACON ONLY	2	5	8	1	1	2
DISCRETE	1	1	1	1	1	1
NON DISCRETE	1	4	7	0	0	1
MODE C	1	2	3	1	1	1
RADAR REINFORCED BEACON	54	125	195	44	44	47
DISCRETE	29	29	29	38	38	38
NON DISCRETE	25	96	166	6	6	9
MODE C	20	53	82	37	37	37
CROSS-LINKED		37			50	
UNUSED TARGET REPORTS	53	56	59	103	103	103
RADAR	52	52	50	100	100	100
BEACON	3	6	9	3	3	3

SYSTEM LOAD VALUES
FOR
CHICAGO CHI-S
1984

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	100.52	208.43	316.35	74.11	76.87	84.62
RADAR ONLY	21.03	48.23	75.43	2.36	5.12	7.98
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	79.49	160.20	240.92	71.75	71.75	76.74
DISCRETE	47.22	47.22	47.22	62.96	62.96	62.96
NON DISCRETE	32.27	112.98	193.69	8.79	8.79	13.77
MODE C	47.22	79.73	115.07	62.96	62.96	62.96

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	152.13	263.39	372.64	173.01	177.01	187.60
RADAR ONLY	73.00	103.00	132.00	104.00	107.00	111.00
BEACON ONLY	6.00	13.00	19.00	3.00	4.00	6.00
DISCRETE	2.00	2.00	3.00	2.00	3.00	5.00
NON DISCRETE	4.00	11.00	16.00	1.00	1.00	1.00
MODE C	4.00	6.00	9.00	2.00	3.00	4.00
RADAR REINFORCED BEACON	73.13	147.39	221.64	66.01	66.01	70.60
DISCRETE	43.44	43.44	43.44	57.93	57.93	57.93
NON DISCRETE	29.69	103.94	178.20	8.08	9.08	12.67
MODE C	43.44	73.35	105.87	57.93	57.93	57.93

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		17			21	
RADAR ONLY		1			1	
BEACON ONLY		1			1	
DISCRETE		1			1	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		15			19	
DISCRETE		13			17	
NON DISCRETE		2			2	
MODE C		14			19	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	83	192	299	53	56	65
RADAR ONLY	23	54	84	4	7	10
BEACON ONLY	2	6	9	2	2	3
DISCRETE	1	1	1	2	2	2
NON DISCRETE	1	5	8	0	0	1
MODE C	1	2	4	2	2	2
RADAR REINFORCED BEACON	58	132	206	47	47	52
DISCRETE	30	30	30	41	41	41
NON DISCRETE	28	102	176	6	6	11
MODE C	29	59	92	39	39	39
CROSS-LINKED		37			50	
UNUSED TARGET REPORTS	53	56	60	103	103	103
RADAR	50	50	50	100	100	100
BEACON	3	6	10	3	3	3

SYSTEM LOAD VALUES

FDP
CHICAGO CH1-S
1996

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	104.31	214.23	323.74	75.57	78.00	86.68
RADAR ONLY	20.25	45.83	71.40	2.15	4.59	7.02
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	84.07	168.20	252.34	73.42	73.42	79.67
DISCRETE	49.50	49.50	49.50	66.00	66.00	66.00
NON DISCRETE	34.56	118.70	202.83	7.42	7.42	13.66
MODE C	49.50	89.38	129.52	56.30	66.00	66.00

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	157.34	268.74	381.15	174.54	179.54	189.29
RADAR ONLY	73.00	101.00	129.00	104.00	107.00	110.00
BEACON ONLY	7.00	13.00	20.00	3.00	5.00	6.00
DISCRETE	2.00	3.00	3.00	2.00	4.00	5.00
NON DISCRETE	5.00	10.00	17.00	1.00	1.00	1.00
MODE C	4.00	7.00	10.00	2.00	3.00	5.00
RADAR REINFORCED BEACON	77.34	154.74	232.15	67.54	67.54	73.29
DISCRETE	45.54	45.54	45.54	60.72	60.72	60.72
NON DISCRETE	31.80	109.20	186.61	6.82	6.82	12.57
MODE C	45.54	32.23	119.16	60.72	60.72	60.72

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		18			23	
RADAR ONLY		1			1	
BEACON ONLY		1			2	
DISCRETE		1			2	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		15			20	
DISCRETE		14			18	
NON DISCRETE		2			2	
MODE C		15			20	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	87	197	306	53	56	55
RADAR ONLY	23	52	80	4	7	9
BEACON ONLY	2	6	9	1	1	2
DISCRETE	1	1	1	1	1	1
NON DISCRETE	1	5	8	0	0	1
MODE C	1	3	4	2	2	2
RADAR REINFORCED BEACON	62	139	217	48	48	54
DISCRETE	32	32	32	43	42	43
NON DISCRETE	30	107	185	5	5	11
MODE C	31	67	104	41	41	41
CROSS-LINKED		39			51	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	53	57	60	103	103	103
RADAR	52	52	52	100	100	100
BEACON	3	7	10	3	3	3

SYSTEM LOAD VALUES
FOR
CHICAGO CHI-5
1988

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	107.55	218.24	328.92	76.12	78.20	88.61
RADAR ONLY	18.36	41.03	63.73	1.91	4.00	6.09
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	89.19	177.21	265.22	74.20	74.20	82.52
DISCRETE	51.72	51.72	51.72	68.96	68.96	68.96
NON DISCRETE	37.48	125.49	213.51	5.25	5.25	13.57
MODE C	51.72	98.88	143.62	58.96	68.96	68.96

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	160.06	273.03	387.01	174.27	179.27	191.92
RADAR ONLY	71.00	95.00	122.00	103.00	106.00	109.00
BEACON ONLY	7.00	14.00	21.00	3.00	5.00	7.00
DISCRETE	2.00	3.00	4.00	2.00	4.00	5.00
NON DISCRETE	5.00	11.00	17.00	1.00	1.00	2.00
MODE C	4.00	8.00	11.00	2.00	4.00	5.00
RADAR REINFORCED BEACON	82.06	163.03	244.01	68.27	68.27	75.92
DISCRETE	47.58	47.58	47.58	63.44	63.44	63.44
NON DISCRETE	34.48	115.45	196.43	4.83	4.83	12.48
MODE C	47.58	90.97	132.12	63.44	63.44	63.44

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		17			23	
RADAR ONLY		1			1	
BEACON ONLY		1			2	
DISCRETE		1			2	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		15			20	
DISCRETE		14			19	
NON DISCRETE		1			1	
MODE C		15			21	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	90	201	312	53	55	65
RADAR ONLY	21	47	73	4	6	9
BEACON ONLY	2	6	10	1	1	2
DISCRETE	1	1	1	1	1	1
NON DISCRETE	1	5	9	0	0	1
MODE C	1	3	5	2	2	2
RADAR REINFORCED BEACON	57	143	229	48	48	55
DISCRETE	34	34	34	44	44	44
NON DISCRETE	33	114	195	4	4	11
MODE C	32	75	116	42	42	42
CROSS-LINKED		39			50	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	54	57	61	103	103	103
BEACON	50	50	50	100	100	100
	4	7	11	3	3	3

SYSTEM LOAD VALUES

FOR

CHICAGO CHI-S

1990

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	110.72	221.86	333.00	76.57	78.32	90.68
RADAR ONLY	17.14	37.82	58.49	1.66	3.41	5.16
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	93.58	184.05	274.51	74.91	74.91	85.52
DISCRETE	53.91	53.91	53.91	71.88	71.88	71.88
NON DISCRETE	39.67	130.14	220.60	3.03	3.03	13.64
MODE C	59.30	108.41	157.53	71.88	71.88	71.88

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	163.09	278.32	391.55	174.91	179.91	193.68
RADAR ONLY	70.00	94.00	117.00	123.00	106.00	108.00
BEACON ONLY	7.00	15.00	22.00	3.00	5.00	7.00
DISCRETE	2.00	3.00	4.00	3.00	4.00	5.00
NON DISCRETE	5.00	12.00	18.00	0.00	1.00	2.00
MODE C	5.00	9.00	13.00	3.00	4.00	5.00
RADAR REINFORCED BEACON	86.09	169.32	252.55	68.91	68.91	78.68
DISCRETE	49.60	49.60	49.60	66.13	66.13	66.13
NON DISCRETE	36.49	119.72	202.96	2.78	2.78	12.55
MODE C	54.55	99.74	144.93	66.13	66.13	66.13

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		18			24	
RADAR ONLY		1			1	
BEACON ONLY		1			2	
DISCRETE		1			2	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		16			21	
DISCRETE		15			20	
NON DISCRETE		1			1	
MODE C		16			22	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	93	204	315	53	54	68
RADAR ONLY	20	44	68	4	5	8
BEACON ONLY	3	6	10	1	1	2
DISCRETE	1	1	1	1	1	1
NON DISCRETE	2	5	9	0	0	1
MODE C	1	3	5	2	2	2
RADAR REINFORCED BEACON	70	154	237	48	48	58
DISCRETE	35	35	35	46	46	46
NON DISCRETE	35	119	202	2	2	12
MODE C	39	84	129	44	44	44
CROSS-LINKED		39			51	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	54	57	61	103	103	103
RADAR	50	50	50	100	100	100
BEACON	4	7	11	3	3	3

SYSTEM LOAD VALUES
FOR

CHICAGO OHARE
1977

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	103.10	212.38	321.66	69.79	74.29	92.35
RADAR ONLY	26.23	61.48	96.72	3.41	7.71	12.01
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	76.87	150.91	224.94	66.58	66.58	80.34
DISCRETE	39.42	39.42	43.07	52.56	52.56	61.80
NON DISCRETE	37.45	111.48	181.87	14.02	14.02	18.54
MODE C	39.42	62.56	86.05	52.56	52.56	52.56

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	154.72	265.83	376.94	169.26	176.26	194.91
RADAR ONLY	78.00	115.00	152.00	105.00	110.00	115.00
BEACON ONLY	6.00	12.00	18.00	3.00	5.00	6.00
DISCRETE	2.00	3.00	3.00	3.00	4.00	5.00
NON DISCRETE	4.00	9.00	15.00	0.00	1.00	1.00
MODE C	3.00	5.00	7.00	2.00	3.00	4.00
RADAR REINFORCED BEACON	70.72	138.83	206.94	61.26	61.26	73.91
DISCRETE	36.27	36.27	39.62	48.36	48.36	56.85
NON DISCRETE	34.46	102.56	167.32	12.90	12.90	17.06
MODE C	36.27	57.56	79.16	48.36	48.36	48.36

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		38			51	
RADAR ONLY		3			4	
BEACON ONLY		3			4	
DISCRETE		2			3	
NON DISCRETE		1			1	
MODE C		1			2	
RADAR REINFORCED BEACON		32			43	
DISCRETE		25			34	
NON DISCRETE		7			9	
MODE C		28			37	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	64	175	284	20	24	42
RADAR ONLY	26	65	103	2	6	11
BEACON ONLY	7	3	6	0	0	0
DISCRETE	0	0	0	0	0	0
NON DISCRETE	0	3	6	0	0	0
MODE C	1	2	2	0	0	0
RADAR REINFORCED BEACON	38	107	175	18	18	31
DISCRETE	11	11	15	14	14	23
NON DISCRETE	27	96	160	4	4	8
MODE C	9	30	51	11	11	11
CROSS-LINKED		15			21	
UNUSED TARGET REPORTS	53	56	59	103	103	103
RADAR	53	50	50	100	100	100
BEACON	3	6	9	3	3	3

SYSTEM LOAD VALUES
FOR
CHICAGO OHARE
1980

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	115.41	234.02	352.63	71.42	75.24	101.84
RADAR ONLY	27.00	61.82	96.65	3.14	6.96	10.78
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	88.41	172.20	255.99	68.28	68.28	91.06
DISCRETE	42.67	42.67	48.57	56.90	56.90	70.58
NON DISCRETE	45.73	129.52	207.42	11.38	11.38	20.48
MODE C	48.51	91.03	113.55	56.90	56.90	64.23
ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	167.33	288.42	408.51	170.82	176.82	204.77
RADAR ONLY	79.00	116.00	153.00	105.00	109.00	114.00
BEACON ONLY	7.00	14.00	20.00	3.00	5.00	7.00
DISCRETE	2.00	3.00	4.00	3.00	4.00	6.00
NON DISCRETE	5.00	11.00	16.00	0.00	1.00	1.00
MODE C	4.00	6.00	9.00	3.00	4.00	5.00
RADAR REINFORCED BEACON	81.33	158.42	235.51	62.82	62.82	83.77
DISCRETE	39.26	39.26	44.68	52.35	52.35	64.93
NON DISCRETE	42.07	119.16	190.83	10.47	10.47	18.84
MODE C	44.63	74.55	104.46	52.35	52.35	59.09
ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		37			52	
RADAR ONLY		3			4	
BEACON ONLY		2			4	
DISCRETE		2			3	
NON DISCRETE		0			1	
MODE C		1			2	
RADAR REINFORCED BEACON		32			44	
DISCRETE		27			37	
NON DISCRETE		5			7	
MODE C		30			40	
UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	79	197	316	20	24	50
RADAR ONLY	29	66	104	2	6	10
BEACON ONLY	2	5	8	0	0	0
DISCRETE	0	0	0	0	0	0
NON DISCRETE	2	5	8	0	0	0
MODE C	1	2	4	0	0	1
RADAR REINFORCED BEACON	49	126	204	18	18	40
DISCRETE	12	12	18	15	15	28
NON DISCRETE	37	114	186	3	3	12
MODE C	15	45	74	12	12	19
CROSS-LINKED		15			21	
UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	54	57	60	103	103	104
RADAR	50	50	50	100	100	100
BEACON	4	7	10	3	3	4

SYSTEM LOAD VALUES

FOR

CHICAGO OHARE

1982

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	120.67	242.36	365.25	72.90	76.30	105.21
RADAR ONLY	25.83	58.37	90.91	2.99	6.54	10.09
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	94.85	184.59	274.34	70.00	69.76	95.12
DISCRETE	44.92	44.92	51.75	59.89	59.89	73.39
NON DISCRETE	49.93	139.68	222.59	10.10	9.87	21.73
MODE C	53.72	91.76	129.80	59.89	59.89	68.50
ADJUSTED						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	174.26	297.93	422.39	173.40	179.18	208.51
RADAR ONLY	79.00	113.00	148.00	105.00	109.00	113.00
BEACON ONLY	8.00	15.00	22.00	4.00	6.00	8.00
DISCRETE	2.00	3.00	4.00	3.00	4.00	6.00
NON DISCRETE	6.00	12.00	18.00	1.00	2.00	2.00
MODE C	4.00	7.00	10.00	3.00	4.00	5.00
RADAR REINFORCED BEACON	87.26	169.83	252.39	64.40	64.18	87.51
DISCRETE	41.33	41.33	47.61	55.10	55.10	67.52
NON DISCRETE	45.93	128.50	204.78	9.29	9.08	19.99
MODE C	49.42	84.42	119.42	55.10	55.10	63.02
ASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		39			53	
RADAR ONLY		3			3	
BEACON ONLY		2			4	
DISCRETE		2			3	
NON DISCRETE		0			1	
MODE C		1			2	
RADAR REINFORCED BEACON		34			46	
DISCRETE		29			39	
NON DISCRETE		5			7	
MODE C		31			42	
UNASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	82	205	327	21	24	53
RADAR ONLY	27	63	99	3	6	11
BEACON ONLY	2	6	9	0	0	0
DISCRETE	0	0	0	0	0	0
NON DISCRETE	2	6	9	0	0	0
MODE C	1	3	4	0	0	1
RADAR REINFORCED BEACON	53	135	219	18	18	42
DISCRETE	12	12	19	16	16	29
NON DISCRETE	41	124	200	2	2	13
MODE C	18	53	88	13	13	21
CROSS-LINKED		15			21	
UNUSED TARGET REPORTS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	54	57	61	103	103	104
BEACON	50	52	50	100	100	100
	4	7	11	3	3	4

SYSTEM LOAD VALUES
FOR
CHICAGO OHARE
1994

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	125.84	251.05	376.27	74.54	78.69	108.37
RADAR ONLY	25.23	56.20	87.17	2.79	5.99	9.20
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	100.61	194.85	289.09	71.75	72.70	99.18
DISCRETE	47.22	47.22	55.27	62.96	62.96	76.36
NON DISCRETE	53.39	147.63	233.82	8.79	9.73	22.81
MODE C	58.48	101.05	143.62	62.96	62.96	72.59
ADJUSTED						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	178.56	307.26	433.97	175.01	181.88	212.24
RADAR ONLY	78.00	112.00	145.00	105.00	109.00	113.00
BEACON ONLY	8.00	16.00	23.00	4.00	6.00	8.00
DISCRETE	3.00	3.00	4.00	3.00	5.00	6.00
NON DISCRETE	5.00	13.00	19.00	1.00	1.00	2.00
MODE C	5.00	8.00	11.00	3.00	4.00	6.00
RADAR REINFORCED BEACON	92.56	179.26	265.97	66.01	66.88	91.24
DISCRETE	43.44	43.44	50.85	57.93	57.93	70.25
NON DISCRETE	49.12	135.82	215.12	8.08	8.96	20.99
MODE C	53.81	92.97	132.13	57.93	57.93	66.78
ASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		39			53	
RADAR ONLY		2			3	
BEACON ONLY		3			3	
DISCRETE		3			3	
NON DISCRETE		0			0	
MODE C		1			2	
RADAR REINFORCED BEACON		34			47	
DISCRETE		30			41	
NON DISCRETE		4			6	
MODE C		33			44	
UNASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	87	213	338	22	26	55
RADAR ONLY	27	62	97	3	6	10
BEACON ONLY	2	6	9	0	0	1
DISCRETE	0	0	0	0	0	0
NON DISCRETE	2	6	9	0	0	1
MODE C	1	3	5	1	1	1
RADAR REINFORCED BEACON	58	145	232	19	20	44
DISCRETE	13	13	21	17	17	29
NON DISCRETE	45	132	211	2	3	15
MODE C	21	60	99	14	14	23
CROSS-LINKED		16			20	
UNUSED TARGET REPORTS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	54	58	62	103	103	104
BEACON	50	50	50	100	100	100
	4	8	12	3	3	4

SYSTEM LOAD VALUES

FDP

CHICAGO SHARE

1986

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	130.17	257.28	384.37	75.97	60.65	110.81
RADAR ONLY	24.26	53.36	82.45	2.55	5.38	3.21
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	105.93	203.92	321.92	73.42	75.27	102.59
DISCRETE	49.50	49.50	58.65	66.00	66.00	78.86
NON DISCRETE	56.43	154.42	243.27	7.42	9.27	23.74
MODE C	64.20	112.15	160.10	66.00	66.00	76.79

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	183.46	312.61	442.77	175.54	183.25	214.39
RADAR ONLY	78.07	109.00	141.00	104.00	108.00	112.00
BEACON ONLY	8.00	16.00	24.00	4.00	6.00	8.00
DISCRETE	3.00	4.00	5.00	3.00	5.00	6.00
NON DISCRETE	5.00	12.00	19.00	1.00	1.00	2.00
MODE C	5.00	9.00	13.00	3.00	5.00	6.00
RADAR REINFORCED BEACON	97.46	187.61	277.77	67.54	69.25	94.39
DISCRETE	45.54	45.54	53.96	60.72	60.72	72.55
NON DISCRETE	51.91	142.07	223.81	6.82	8.53	21.84
MODE C	59.05	123.18	147.29	60.72	60.72	70.64

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		41			54	
RADAR ONLY		2			2	
BEACON ONLY		3			4	
DISCRETE		3			4	
NON DISCRETE		0			0	
MODE C		1			2	
RADAR REINFORCED BEACON		36			48	
DISCRETE		32			43	
NON DISCRETE		4			5	
MODE C		35			46	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	90	218	345	23	28	58
RADAR ONLY	26	60	93	3	6	10
BEACON ONLY	2	6	10	0	0	1
DISCRETE	0	0	0	0	0	0
NON DISCRETE	2	6	10	0	0	1
MODE C	2	3	5	1	1	1
RADAR REINFORCED BEACON	62	152	242	20	22	47
DISCRETE	14	14	22	19	18	30
NON DISCRETE	48	138	220	2	4	17
MODE C	24	68	112	15	15	25
CROSS-LINKED		17			22	
UNUSED TARGET REPORTS	54	58	62	103	103	104
RADAR	50	50	50	100	100	100
BEACON	4	8	12	3	3	4

SYSTEM LOAD VALUE

FJR

CHICAGO OHARE

1988

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	133.99	252.12	390.25	75.47	82.55	113.06
RADAR ONLY	22.00	47.78	73.57	2.27	4.70	7.14
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	111.99	214.34	316.69	74.20	77.84	105.92
DISCRETE	51.72	51.72	62.49	68.96	68.96	81.20
NON DISCRETE	60.28	162.62	254.19	5.25	8.89	24.72
MODE C	69.99	123.12	176.24	68.96	68.96	80.92

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	188.03	318.19	449.35	176.27	185.61	216.45
RADAR ONLY	76.00	104.00	133.00	104.00	108.00	111.00
BEACON ONLY	9.00	17.00	25.00	4.00	6.00	8.00
DISCRETE	3.00	4.00	5.00	3.00	5.00	6.00
NON DISCRETE	6.00	13.00	20.00	1.00	1.00	2.00
MODE C	6.00	10.00	14.00	3.00	5.00	6.00
RADAR REINFORCED BEACON	103.03	197.19	291.35	69.27	71.61	97.45
DISCRETE	47.58	47.58	57.49	63.44	63.44	74.70
NON DISCRETE	55.45	149.61	233.86	4.83	8.18	22.74
MODE C	64.39	113.27	162.14	53.44	63.44	74.45

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		41			53	
RADAR ONLY		2			2	
BEACON ONLY		3			4	
DISCRETE		3			4	
NON DISCRETE		0			0	
MODE C		1			2	
RADAR REINFORCED BEACON		36			47	
DISCRETE		33			44	
NON DISCRETE		3			3	
MODE C		36			48	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	93	223	349	24	30	61
RADAR ONLY	24	54	84	3	6	9
BEACON ONLY	2	7	10	0	0	1
DISCRETE	0	0	0	0	0	0
NON DISCRETE	2	7	10	0	0	1
MODE C	2	4	6	1	1	1
RADAR REINFORCED BEACON	67	162	255	21	24	51
DISCRETE	15	15	24	19	19	31
NON DISCRETE	52	147	231	2	5	20
MODE C	28	77	126	15	15	26
CROSS-LINKED		16			22	
UNUSED TARGET REPORTS	54	59	63	103	103	104
RADAR	50	53	50	100	100	100
BEACON	4	9	13	3	3	4

SYSTEM LOAD VALUES

FJR

CHICAGO SHARE

1992

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	137.87	266.82	395.77	76.87	84.74	115.66
RADAR ONLY	20.58	44.15	67.72	1.97	4.02	6.07
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	117.29	222.67	328.05	74.91	80.71	109.58
DISCRETE	53.91	53.91	66.09	71.88	71.88	83.74
NON DISCRETE	63.38	168.76	261.96	3.03	8.83	25.84
MODE C	76.14	134.37	192.60	71.88	71.88	85.29

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	190.91	323.86	455.80	176.91	187.26	219.82
RADAR ONLY	74.00	101.00	128.00	104.00	107.00	110.00
BEACON ONLY	9.00	18.00	26.00	4.00	6.00	9.00
DISCRETE	3.00	4.00	5.00	3.00	5.00	7.00
NON DISCRETE	6.00	14.00	21.00	1.00	1.00	2.00
MODE C	6.00	11.00	15.00	4.00	5.00	7.00
RADAR REINFORCED BEACON	107.91	204.86	301.80	68.91	74.26	100.82
DISCRETE	49.60	49.60	60.80	66.13	66.13	77.04
NON DISCRETE	58.31	155.26	241.00	2.78	8.13	23.78
MODE C	70.05	123.62	177.19	66.13	66.13	78.46

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		41			54	
RADAR ONLY		2			2	
BEACON ONLY		3			4	
DISCRETE		3			4	
NON DISCRETE		0			0	
MODE C		2			2	
RADAR REINFORCED BEACON		36			48	
DISCRETE		35			46	
NON DISCRETE		1			2	
MODE C		38			50	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	98	227	355	24	31	62
RADAR ONLY	23	51	79	3	5	8
BEACON ONLY	3	7	10	0	0	1
DISCRETE	0	0	0	0	0	0
NON DISCRETE	3	7	10	0	0	1
MODE C	1	3	6	1	1	1
RADAR REINFORCED BEACON	72	169	266	21	26	53
DISCRETE	15	15	26	20	20	31
NON DISCRETE	57	154	240	1	6	22
MODE C	32	96	139	16	16	28
CROSS-LINKED		17			23	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	55	59	63	103	103	104
BEACON	50	50	50	100	100	100
	5	9	13	3	3	4

APPENDIX I

IAC SYSTEM LOAD FACTORS FOR THE
LOS ANGELES TRACON SURVEILLANCE SITES

SYSTEM LOAD VALUES
EQP
LOS ANGELES LAX4
1977

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	155.62	271.26	386.91	60.45	76.19	106.87
RADAR ONLY	46.03	80.39	114.76	5.65	9.68	13.70
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	109.60	190.87	272.15	54.79	66.52	93.17
DISCRETE	32.44	34.10	46.83	43.26	51.24	71.49
NON DISCRETE	77.15	156.77	225.31	11.54	15.27	21.67
MODE C	43.35	74.99	106.62	43.26	43.26	62.93

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	208.83	325.60	443.37	160.41	178.19	209.71
RADAR ONLY	99.00	135.22	171.00	107.00	112.00	117.00
BEACON ONLY	9.00	15.00	22.00	3.00	5.00	7.00
DISCRETE	2.00	3.00	4.00	2.00	4.00	6.00
NON DISCRETE	7.00	12.00	18.00	1.00	1.00	1.00
MODE C	3.00	6.00	9.00	2.00	4.00	5.00
RADAR REINFORCED BEACON	100.83	175.60	250.37	50.41	61.19	65.71
DISCRETE	29.85	31.38	42.09	39.84	47.14	65.77
NON DISCRETE	70.98	144.22	207.28	10.61	14.05	19.94
MODE C	39.69	58.99	86.09	39.80	39.60	57.90

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		23			33	
RADAR ONLY		2			3	
BEACON ONLY		1			2	
DISCRETE		1			2	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		20			28	
DISCRETE		15			22	
NON DISCRETE		4			6	
MODE C		18			24	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	132	247	344	28	43	76
RADAR ONLY	40	86	124	5	9	14
BEACON ONLY	3	4	10	0	1	2
DISCRETE	0	0	1	0	0	1
NON DISCRETE	3	4	5	0	1	1
MODE C	1	2	2	1	1	2
RADAR REINFORCED BEACON	81	155	230	23	32	58
DISCRETE	14	15	27	18	25	4
NON DISCRETE	67	140	203	5	8	10
MODE C	22	51	80	16	16	34
CROSS-LINKED		20			27	

UNISSUED TRACK REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	54	58	61	102	103	104
RADAR	50	50	50	100	100	100
BEACON	4	8	11	2	3	4

SYSTEM LOAD VALUES
FDP
LOS ANGELES LAX4
1982

PASS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	170.74	291.24	411.37	67.20	82.55	114.04
RADAR ONLY	46.10	78.70	111.30	5.19	8.62	12.04
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MTN DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	124.61	212.34	300.07	62.01	73.94	102.61
DISCRETE	38.75	38.75	51.78	51.67	57.35	79.40
NON DISCRETE	85.86	173.59	248.29	10.33	16.58	23.21
MODE C	56.57	96.08	135.58	51.67	51.67	72.37

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	223.64	345.35	469.06	148.05	185.02	218.40
RADAR ONLY	99.60	134.00	169.60	107.00	111.00	116.00
BEACON ONLY	10.00	17.00	24.00	4.00	6.00	8.00
DISCRETE	2.00	3.00	4.00	3.00	5.00	6.00
NON DISCRETE	8.00	14.00	20.00	1.00	1.00	2.00
MODE C	5.00	9.00	11.00	3.00	4.00	6.00
RADAR REINFORCED BEACON	114.54	195.35	276.06	57.05	68.02	94.40
DISCRETE	35.65	35.55	47.64	47.54	52.77	73.05
NON DISCRETE	79.69	159.70	228.42	9.51	15.26	21.35
MODE C	52.65	88.39	124.73	47.54	47.54	66.58

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		28			26	
RADAR ONLY		2			2	
BEACON ONLY		2			2	
DISCRETE		2			2	
MTN DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		24			21	
DISCRETE		20			26	
NON DISCRETE		4			5	
MODE C		21			28	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	143	264	383	32	47	78
RADAR ONLY	49	85	121	5	9	13
BEACON ONLY	3	7	10	3	1	2
DISCRETE	0	0	0	0	0	1
MTN DISCRETE	3	7	10	3	1	1
MODE C	1	1	4	1	1	2
RADAR REINFORCED BEACON	91	172	252	27	37	63
DISCRETE	16	16	29	22	27	47
NON DISCRETE	75	156	224	5	10	16
MODE C	21	47	104	20	20	39
CROSS-LINKER		22			29	

THINER TARGET PROPERTIES	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	55	59	62	102	103	104
BEACON	5	9	12	5	3	4

SYSTEM LOAD VALUES
FOR
LOS ANGELES LAX4
1982

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	177.02	298.70	420.29	71.34	85.88	118.73
RADAR ONLY	43.24	73.06	102.69	4.91	8.05	11.19
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	133.79	225.64	217.49	66.44	77.83	107.54
DISCRETE	42.64	42.64	56.24	56.85	60.27	83.11
NON DISCRETE	91.15	183.00	241.25	9.59	17.56	24.43
MODE C	64.97	109.28	153.59	56.85	56.85	77.80

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	231.08	354.59	478.09	172.12	188.60	222.94
RADAR ONLY	97.00	129.00	161.00	107.00	111.00	115.00
BEACON ONLY	11.00	18.00	25.00	4.00	6.00	9.00
DISCRETE	2.00	3.00	5.00	3.00	5.00	7.00
NON DISCRETE	9.00	15.00	20.00	1.00	1.00	2.00
MODE C	5.00	9.00	12.00	3.00	5.00	6.00
RADAR REINFORCED BEACON	123.08	207.59	292.09	61.12	71.60	98.94
DISCRETE	39.23	39.23	51.74	52.30	55.45	76.46
NON DISCRETE	83.86	168.36	240.35	8.82	16.15	22.48
MODE C	59.77	100.54	141.30	52.30	52.30	71.58

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		30			39	
RADAR ONLY		2			2	
BEACON ONLY		2			2	
DISCRETE		2			2	
NON DISCRETE		2			2	
MODE C		1			1	
RADAR REINFORCED BEACON		24			24	
DISCRETE		22			29	
NON DISCRETE		4			5	
MODE C		23			31	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	148	269	390	32	46	78
RADAR ONLY	47	80	114	5	8	12
BEACON ONLY	4	7	10	0	1	2
DISCRETE	0	0	0	0	0	1
NON DISCRETE	4	7	10	0	1	1
MODE C	2	3	5	1	1	2
RADAR REINFORCED BEACON	97	181	266	27	37	64
DISCRETE	17	17	30	23	26	47
NON DISCRETE	80	164	236	4	11	17
MODE C	37	73	118	21	21	41
CROSS-LINKED		24			32	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	55	59	63	103	103	104
RADAR	50	50	54	100	100	100
BEACON	5	9	12	3	3	4

SYSTEM LOAD VALUES

FOR
LOS ANGELES LAX4
1984

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	183.72	306.25	428.78	74.23	59.46	123.01
RADAR ONLY	41.64	69.53	97.42	4.57	7.41	10.24
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	142.08	236.72	331.36	69.66	52.05	112.77
DISCRETE	45.84	45.84	61.16	51.12	61.12	87.13
NON DISCRETE	96.23	190.87	270.20	18.53	20.93	25.63
MODE C	72.55	120.59	156.63	51.12	61.12	83.06

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	237.71	362.78	486.85	174.08	192.49	226.75
RADAR ONLY	96.00	126.00	157.00	106.00	110.00	114.00
BEACON ONLY	11.00	19.00	27.00	4.00	7.00	9.00
DISCRETE	2.00	4.00	5.00	3.00	5.00	7.00
NON DISCRETE	9.00	15.00	22.00	1.00	2.00	2.00
MODE C	6.00	10.00	13.00	3.00	5.00	7.00
RADAR REINFORCED BEACON	120.71	217.78	304.85	64.08	75.49	103.75
DISCRETE	42.18	42.18	56.27	56.23	56.23	62.16
NON DISCRETE	88.54	175.60	248.58	7.85	19.26	23.58
MODE C	66.75	110.94	155.14	56.23	56.23	76.41

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	2	2	4	2	2	4
RADAR ONLY	2	2	4	2	2	4
BEACON ONLY	2	2	4	2	2	4
DISCRETE	2	2	4	2	2	4
NON DISCRETE	0	0	0	0	0	0
MODE C	1	1	2	1	1	2
RADAR REINFORCED BEACON	24	24	48	24	24	48
DISCRETE	23	23	46	23	23	46
NON DISCRETE	3	3	6	3	3	6
MODE C	25	25	50	25	25	50

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	154	277	399	34	50	83
RADAR ONLY	45	77	109	5	9	13
BEACON ONLY	4	8	11	0	1	1
DISCRETE	0	0	0	0	0	0
NON DISCRETE	4	8	11	0	1	1
MODE C	2	4	6	1	2	3
RADAR REINFORCED BEACON	105	192	279	29	40	69
DISCRETE	19	19	33	25	25	49
NON DISCRETE	85	173	246	4	15	20
MODE C	42	86	130	22	22	42
CROSS-LINKED	23	23	46	23	23	46

UNISSUED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	56	59	63	103	103	105
RADAR	50	50	50	100	100	100
BEACON	6	9	13	3	3	5

SYSTEM LOAD VALUES
FCP
LOS ANGELES LAX4
1986

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	189.47	312.53	435.19	77.41	92.12	126.10
RADAR ONLY	39.71	65.59	91.48	4.15	6.65	9.14
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	149.76	246.94	344.11	73.26	85.47	116.96
DISCRETE	49.40	49.40	65.57	65.86	65.86	90.33
NON DISCRETE	100.37	197.54	278.54	7.40	19.61	26.63
MODE C	81.47	134.12	186.76	65.86	65.86	88.22

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	243.79	370.18	496.56	177.40	195.64	229.00
RADAR ONLY	94.67	122.30	152.00	106.00	116.00	113.00
BEACON ONLY	12.00	20.00	28.00	4.00	7.00	9.00
DISCRETE	2.00	4.00	5.00	3.00	5.00	7.00
NON DISCRETE	10.00	16.00	23.00	1.00	2.00	2.00
MODE C	7.00	11.00	15.00	3.00	5.00	7.00
RADAR REINFORCED BEACON	137.78	227.18	316.58	67.40	78.64	107.60
DISCRETE	45.44	45.44	60.33	50.59	60.59	83.14
NON DISCRETE	92.34	181.74	256.25	6.81	18.04	24.50
MODE C	74.95	123.39	171.82	60.59	60.59	81.16

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		31			42	
RADAR ONLY		1			2	
BEACON ONLY		2			3	
DISCRETE		2			3	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		28			37	
DISCRETE		25			33	
NON DISCRETE		3			4	
MODE C		27			36	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	158	281	404	36	51	84
RADAR ONLY	45	74	104	5	8	12
BEACON ONLY	4	8	12	0	1	2
DISCRETE	0	0	1	0	0	1
NON DISCRETE	4	8	11	0	1	1
MODE C	2	4	6	2	2	3
RADAR REINFORCED BEACON	109	199	288	31	42	70
DISCRETE	20	20	25	28	28	50
NON DISCRETE	89	179	263	3	14	20
MODE C	48	96	143	25	21	45
CROSS-LINKED		25			34	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	56	50	64	103	102	105
BEACON	50	50	50	170	100	100
MODE C	6	10	14	3	2	5

SYSTEM LOAD VALUES
FOR
LOS ANGELES LAX4
1988

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	194.47	318.19	441.70	81.34	94.56	129.11
RADAR ONLY	35.82	58.62	81.41	3.66	5.81	7.95
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	158.64	259.47	360.29	77.68	88.75	121.16
DISCRETE	54.14	54.14	70.61	72.19	72.19	93.33
NON DISCRETE	104.50	205.33	289.68	5.49	16.57	27.83
MODE C	90.25	147.56	204.86	72.19	72.19	93.34
ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	240.95	376.71	503.47	182.46	197.65	233.47
RADAR ONLY	91.00	117.00	143.00	106.00	109.00	112.00
BEACON ONLY	13.00	21.00	29.00	5.00	7.00	10.00
DISCRETE	3.00	4.00	6.00	3.00	5.00	7.00
NON DISCRETE	10.00	17.00	23.00	2.00	2.00	3.00
MODE C	7.00	12.00	16.00	3.00	5.00	7.00
RADAR REINFORCED BEACON	145.95	238.71	331.47	71.46	81.65	111.47
DISCRETE	49.61	49.61	64.96	55.41	66.41	85.67
NON DISCRETE	96.14	188.90	266.50	5.05	15.24	25.60
MODE C	83.03	135.75	186.47	66.41	66.41	85.67
ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		23			45	
RADAR ONLY		2			2	
BEACON ONLY		2			3	
DISCRETE		2			3	
NON DISCRETE		0			0	
MODE C		1			2	
RADAR REINFORCED BEACON		29			40	
DISCRETE		27			37	
NON DISCRETE		2			3	
MODE C		30			40	
UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	161	285	410	36	49	85
RADAR ONLY	40	67	94	5	7	11
BEACON ONLY	4	8	12	0	1	2
DISCRETE	0	0	1	0	0	1
NON DISCRETE	4	8	12	0	1	1
MODE C	3	5	7	1	1	2
RADAR REINFORCED BEACON	117	210	303	31	41	72
DISCRETE	23	23	38	29	29	49
NON DISCRETE	94	187	265	2	12	23
MODE C	53	106	155	26	26	46
CROSS-LINKED		27			36	
UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	50	50	50	100	100	100
BEACON	5	10	14	3	4	5

SYSTEM LOAD VALUES

FDR
LOS ANGELES LAX4
199J

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	200.09	324.43	448.76	55.18	98.16	133.75
RADAR ONLY	33.23	54.00	74.67	3.14	4.93	6.71
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	166.76	270.43	374.10	82.04	93.25	127.04
DISCRETE	59.04	59.04	76.65	78.72	78.72	97.98
NON DISCRETE	107.72	211.39	297.25	3.31	14.53	29.06
MODE C	100.10	162.43	224.75	78.72	78.72	100.19

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	255.42	393.79	511.17	185.48	200.79	238.88
RADAR ONLY	89.67	113.00	137.10	105.00	108.00	112.00
BEACON ONLY	13.00	22.00	30.00	5.00	7.00	10.00
DISCRETE	3.00	5.00	6.00	4.00	6.00	8.00
NON DISCRETE	10.00	17.00	24.00	1.00	1.00	2.00
MODE C	8.00	13.00	18.00	4.00	6.00	8.00
RADAR REINFORCED BEACON	151.42	248.79	344.17	75.48	85.79	116.88
DISCRETE	54.32	54.32	70.70	72.43	72.43	90.14
NON DISCRETE	99.10	194.47	273.47	2.05	13.37	26.73
MODE C	92.09	149.43	206.78	72.43	72.43	92.17

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		35			47	
RADAR ONLY		2			2	
BEACON ONLY		2			2	
DISCRETE		2			2	
NON DISCRETE		0			0	
MODE C		1			2	
RADAR REINFORCED BEACON		31			42	
DISCRETE		30			40	
NON DISCRETE		1			2	
MODE C		32			43	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	164	288	414	27	51	87
RADAR ONLY	34	53	68	4	7	10
BEACON ONLY	4	9	13	0	2	2
DISCRETE	3	0	1	0	0	1
NON DISCRETE	4	8	12	0	1	1
MODE C	3	5	9	1	1	2
RADAR REINFORCED BEACON	122	217	313	23	43	75
DISCRETE	24	24	41	32	32	50
NON DISCRETE	98	193	272	1	11	25
MODE C	60	117	175	29	29	40
CROSS-LINKED		29			39	

UNUSED TRACK REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	57	61	65	103	104	105
BEACON	50	50	50	100	100	100
	7	11	15	9	4	5

SYSTEM LOAD VALUES
FDP
LJS ANGELES LAX7
1977

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	156.40	271.46	384.12	60.41	75.69	106.39
RADAR ONLY	46.29	80.45	114.62	5.62	9.60	13.59
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	110.11	191.01	271.50	54.79	66.09	92.80
DISCRETE	32.44	34.07	46.77	43.26	51.12	71.29
NON DISCRETE	77.67	156.93	224.73	11.54	15.17	21.51
MODE C	43.50	75.04	106.57	43.26	43.26	62.81

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	209.31	325.72	443.15	140.41	177.99	209.37
RADAR ONLY	99.00	135.00	171.00	107.00	112.00	117.00
BEACON ONLY	9.00	15.00	22.00	3.00	5.00	7.00
DISCRETE	2.00	3.00	4.00	2.00	4.00	6.00
NON DISCRETE	7.00	12.00	18.00	1.00	1.00	1.00
MODE C	3.00	6.00	9.00	2.00	4.00	5.00
RADAR REINFORCED BEACON	101.31	175.73	250.15	50.41	60.99	85.37
DISCRETE	29.85	31.35	43.62	39.80	47.03	65.59
NON DISCRETE	71.46	144.38	207.12	10.61	13.95	19.79
MODE C	40.02	69.03	98.05	39.80	39.80	57.78

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		20			27	
RADAR ONLY		2			2	
BEACON ONLY		1			2	
DISCRETE		1			2	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		17			23	
DISCRETE		13			18	
NON DISCRETE		4			5	
MODE C		15			19	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	125	250	366	34	49	80
RADAR ONLY	49	84	123	6	10	15
BEACON ONLY	3	5	10	0	1	2
DISCRETE	2	0	1	0	0	1
NON DISCRETE	2	5	9	0	1	1
MODE C	1	2	3	1	1	2
RADAR REINFORCED BEACON	84	158	233	28	38	63
DISCRETE	17	18	30	22	20	48
NON DISCRETE	67	140	203	6	9	15
MODE C	25	54	62	21	21	39
CROSS-LINKED		22			33	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	54	59	61	102	103	104
RADAR	50	50	50	100	100	100
BEACON	4	9	11	2	3	4

SYSTEM LOAD VALUES
FOR
LOS ANGELES LAX7
(198)

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	171.14	290.51	409.83	67.10	82.20	114.09
RADAR ONLY	46.24	78.53	110.81	5.16	8.55	11.93
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	124.94	211.98	299.02	52.01	73.65	102.16
DISCRETE	38.75	38.75	51.68	51.57	57.19	79.14
NON DISCRETE	86.19	173.23	247.34	10.33	16.46	23.02
MODE C	56.69	95.97	135.25	51.57	51.67	72.18

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	223.94	346.02	467.10	148.05	184.76	217.99
RADAR ONLY	99.00	134.00	168.00	127.00	111.00	118.00
BEACON ONLY	10.00	17.00	24.00	4.00	6.00	8.00
DISCRETE	2.00	3.00	4.00	3.00	5.00	6.00
NON DISCRETE	8.00	14.00	20.00	1.00	1.00	2.00
MODE C	5.00	8.00	11.00	2.00	4.00	6.00
RADAR REINFORCED BEACON	114.94	195.02	275.10	57.05	67.76	93.99
DISCRETE	35.65	35.65	47.55	47.54	52.82	72.81
NON DISCRETE	79.29	159.37	227.55	9.51	15.15	21.18
MODE C	52.16	98.29	124.43	47.54	47.54	56.41

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		22			29	
RADAR ONLY		2			2	
BEACON ONLY		1			2	
DISCRETE		1			2	
NON DISCRETE		1			1	
MODE C		1			1	
RADAR REINFORCED BEACON		19			25	
DISCRETE		16			21	
NON DISCRETE		3			4	
MODE C		17			23	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	149	263	389	39	53	85
RADAR ONLY	49	85	121	6	9	14
BEACON ONLY	4	8	11	0	1	2
DISCRETE	1	1	1	0	1	1
NON DISCRETE	3	7	10	0	1	1
MODE C	1	3	4	1	1	2
RADAR REINFORCED BEACON	95	176	257	33	43	69
DISCRETE	20	20	32	27	32	52
NON DISCRETE	75	156	225	6	11	17
MODE C	35	71	107	25	25	43
CROSS-LINKED		24			36	

INCLUDED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	55	58	62	102	102	104
RADAR	50	50	50	100	100	100
BEACON	5	8	12	2	2	4

SYSTEM LOAD VALUES
FOR
LOS ANGELES LAX7
1982

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	177.33	297.95	418.51	71.31	85.50	118.15
RADAR ONLY	43.34	72.84	102.35	4.87	7.98	11.09
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	134.05	225.10	316.16	66.44	77.52	107.06
DISCRETE	42.64	42.64	56.11	56.85	56.85	62.82
NON DISCRETE	91.41	182.47	260.05	9.59	20.67	24.24
MODE C	65.07	109.09	153.11	56.85	56.85	77.58
ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	231.32	354.10	476.87	172.12	188.32	222.50
RADAR ONLY	97.00	129.00	161.00	107.00	111.00	115.00
BEACON ONLY	11.00	18.00	25.00	4.00	6.00	9.00
DISCRETE	2.00	3.00	4.00	3.00	5.00	7.00
NON DISCRETE	9.00	15.00	21.00	1.00	1.00	2.00
MODE C	5.00	9.00	12.00	3.00	5.00	6.00
RADAR REINFORCED BEACON	123.32	217.10	296.87	51.12	71.32	98.50
DISCRETE	39.23	39.23	51.62	52.30	52.30	76.19
NON DISCRETE	84.10	167.87	239.24	5.32	19.02	22.30
MODE C	59.67	100.36	140.86	52.30	52.30	71.37
ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		24			22	
RADAR ONLY		2			2	
BEACON ONLY		1			2	
DISCRETE		1			2	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		21			20	
DISCRETE		18			24	
NON DISCRETE		3			4	
MODE C		19			20	
UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	154	274	394	39	53	85
RADAR ONLY	47	80	112	6	9	13
BEACON ONLY	5	8	11	0	1	2
DISCRETE	1	1	1	0	0	1
NON DISCRETE	4	7	10	0	1	1
MODE C	2	3	5	1	1	2
RADAR REINFORCED BEACON	102	186	270	33	42	70
DISCRETE	21	21	34	28	28	52
NON DISCRETE	81	165	236	5	15	18
MODE C	41	81	122	26	20	45
CROSS-LINKER		30			34	
INCLUDED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	55	50	63	103	103	104
RADAR	50	50	50	100	100	100
BEACON	5	0	13	3	3	4

SYSTEM LOAD VALUES
FOR
LOS ANGELES LAX7
1984

CASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	183.98	305.31	426.64	75.19	89.06	122.40
RADAR ONLY	41.71	69.28	96.85	4.54	7.34	10.15
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	142.27	236.03	329.79	69.65	81.72	112.25
DISCRETE	45.84	45.84	61.00	61.12	61.12	86.82
NON DISCRETE	96.43	190.19	268.79	8.53	20.59	25.43
MODE C	72.63	120.32	168.61	61.12	61.12	82.80
ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	237.89	362.15	485.41	174.08	192.18	226.27
RADAR ONLY	96.00	125.00	156.00	106.00	116.00	116.00
BEACON ONLY	11.00	19.00	26.00	4.00	7.00	9.00
DISCRETE	2.00	4.00	5.00	3.00	5.00	7.00
NON DISCRETE	9.00	15.00	21.00	1.00	2.00	2.00
MODE C	6.00	10.00	13.00	3.00	5.00	7.00
RADAR REINFORCED BEACON	130.89	217.15	303.41	57.08	75.18	103.27
DISCRETE	42.18	42.18	56.12	56.23	56.23	79.87
NON DISCRETE	88.72	174.97	247.28	7.85	18.94	23.40
MODE C	66.82	110.70	154.57	56.23	56.23	76.17
ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		25			23	
RADAR ONLY		1			2	
BEACON ONLY		2			2	
DISCRETE		2			2	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		22			29	
DISCRETE		10			25	
NON DISCRETE		3			4	
MODE C		21			28	
UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	159	281	401	40	56	89
RADAR ONLY	46	78	109	5	5	13
BEACON ONLY	4	9	11	0	1	2
DISCRETE	0	0	0	0	0	1
NON DISCRETE	4	9	11	0	1	1
MODE C	2	4	6	1	1	2
RADAR REINFORCED BEACON	109	195	291	35	46	74
DISCRETE	23	23	37	31	31	55
NON DISCRETE	86	172	244	4	15	19
MODE C	40	90	134	29	28	48
CROSS-LINKED		30			40	
UNRECORDED TARGET REPORTS	56	59	63	103	103	104
RADAR	50	50	50	100	100	100
BEACON	6	9	13	3	3	4

SYSTEM LOAD VALUES

FDP
LOS ANGELES LAX7
1986

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	189.66	311.46	433.26	77.38	91.70	125.47
RADAR ONLY	39.75	65.33	90.90	4.12	6.59	9.06
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	149.91	246.13	342.36	73.26	85.11	116.40
DISCRETE	49.40	49.40	65.39	65.86	65.86	69.99
NON DISCRETE	100.51	196.74	276.96	7.40	19.25	26.41
MODE C	81.53	133.76	186.00	65.86	65.86	87.92
ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	243.92	369.44	492.07	177.40	195.30	229.09
RADAR ONLY	94.00	123.00	151.00	106.00	116.00	113.00
BEACON ONLY	12.00	20.00	27.00	4.00	7.00	9.00
DISCRETE	2.00	4.00	5.00	3.00	5.00	7.00
NON DISCRETE	10.00	16.00	22.00	1.00	2.00	2.00
MODE C	7.00	11.00	15.00	3.00	2.00	7.00
RADAR REINFORCED BEACON	137.92	226.44	314.97	67.40	78.30	107.09
DISCRETE	45.44	45.44	60.16	60.59	60.59	82.79
NON DISCRETE	92.47	181.00	254.81	6.81	17.71	24.30
MODE C	75.01	123.06	171.12	60.59	60.59	90.89
ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		25			34	
RADAR ONLY		1			2	
BEACON ONLY		2			2	
DISCRETE		2			2	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		22			30	
DISCRETE		20			27	
NON DISCRETE		2			3	
MODE C		22			30	
UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	154	286	409	44	59	92
RADAR ONLY	45	74	104	5	8	12
BEACON ONLY	4	8	12	1	2	3
DISCRETE	2	0	1	1	1	2
NON DISCRETE	4	8	11	0	1	1
MODE C	2	4	6	2	2	3
RADAR REINFORCED BEACON	115	204	293	38	49	77
DISCRETE	25	25	40	34	34	56
NON DISCRETE	60	179	253	4	15	21
MODE C	53	101	149	31	31	51
CROSS-INDEXED		31			42	
UNLSED TRACK REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	54	40	54	103	103	103
BEACON	60	50	50	100	100	100
	6	10	14	3	2	5

SYSTEM LOAD VALUES

FDP

LOS ANGELES LAY7

1988

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	194.62	316.93	429.24	31.32	94.13	128.46
RADAR ONLY	35.86	58.37	80.88	3.64	5.76	7.88
REACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED REACON	158.76	258.56	358.25	77.68	88.37	120.58
DISCRETE	54.14	54.14	70.41	72.19	72.19	92.98
NON DISCRETE	104.62	204.42	287.84	5.49	16.18	27.60
MODE C	90.31	147.13	203.95	72.19	72.19	93.01

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	250.66	374.88	500.69	101.46	197.30	232.93
RADAR ONLY	91.02	116.22	142.00	176.00	109.00	112.00
REACON ONLY	13.00	21.00	29.00	4.00	7.00	10.00
DISCRETE	3.00	4.00	6.00	3.00	5.00	7.00
NON DISCRETE	10.00	17.00	23.00	1.00	2.00	3.00
MODE C	7.00	12.00	16.00	3.00	5.00	7.00
RADAR REINFORCED REACON	146.66	237.88	329.69	71.46	61.30	110.93
DISCRETE	49.81	49.81	64.78	64.41	66.41	85.54
NON DISCRETE	96.85	188.07	264.91	5.05	14.89	25.39
MODE C	83.08	135.36	187.64	64.41	66.41	85.57

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		27			36	
RADAR ONLY		1			2	
REACON ONLY		2			2	
DISCRETE		2			2	
NON DISCRETE		2			0	
MODE C		1			1	
RADAR REINFORCED REACON		24			32	
DISCRETE		22			30	
NON DISCRETE		2			2	
MODE C		24			32	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	167	290	412	45	58	93
RADAR ONLY	41	68	84	5	7	11
REACON ONLY	4	8	13	1	2	3
DISCRETE	0	0	1	1	1	2
NON DISCRETE	4	8	12	0	1	1
MODE C	3	5	7	2	2	3
RADAR REINFORCED REACON	122	214	306	39	49	79
DISCRETE	28	28	43	34	36	56
NON DISCRETE	94	186	263	3	13	23
MODE C	50	111	154	24	34	54
CROSS-LINKED		23			45	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	55	60	64	102	104	105
REACON	50	50	50	100	100	100
MODE C	5	10	14	3	4	5

SYSTEM LOAD VALUES
FOR
LOS ANGELES LAX7
1992

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	200.21	223.21	446.21	95.16	97.71	133.06
RADAR ONLY	33.35	53.75	74.17	3.12	4.89	6.65
BEACON ONLY	0.00	0.00	0.00	0.00	0.00	0.00
DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
NON DISCRETE	0.00	0.00	0.00	0.00	0.00	0.00
MODE C	0.00	0.00	0.00	0.00	0.00	0.00
RADAR REINFORCED BEACON	166.65	259.45	272.04	82.04	92.83	126.40
DISCRETE	59.04	59.04	76.60	76.72	78.72	97.58
NON DISCRETE	107.61	210.40	295.44	3.31	14.10	28.82
MODE C	100.14	161.92	222.70	78.72	78.72	99.79

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	255.53	381.89	508.28	195.48	200.40	237.29
RADAR ONLY	89.00	112.00	136.00	105.00	108.00	111.00
BEACON ONLY	13.00	22.00	30.00	5.00	7.00	10.00
DISCRETE	3.00	5.00	6.00	4.00	6.00	8.00
NON DISCRETE	10.00	17.00	24.00	1.00	1.00	2.00
MODE C	8.00	13.00	18.00	4.00	6.00	8.00
RADAR REINFORCED BEACON	153.50	247.89	342.28	75.48	85.40	116.29
DISCRETE	54.22	54.22	76.47	72.43	72.43	89.77
NON DISCRETE	99.18	193.57	271.81	3.05	12.98	26.52
MODE C	92.12	146.96	205.80	72.43	72.43	91.81

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		28			39	
RADAR ONLY		1			2	
BEACON ONLY		2			3	
DISCRETE		2			3	
NON DISCRETE		0			0	
MODE C		1			1	
RADAR REINFORCED BEACON		25			34	
DISCRETE		24			33	
NON DISCRETE		1			1	
MODE C		27			35	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	171	295	416	45	56	95
RADAR ONLY	39	64	88	4	7	10
BEACON ONLY	4	8	13	0	2	2
DISCRETE	0	0	1	0	0	1
NON DISCRETE	4	8	12	0	1	1
MODE C	3	5	8	2	2	3
RADAR REINFORCED BEACON	120	223	317	41	51	83
DISCRETE	30	30	46	39	39	57
NON DISCRETE	98	193	271	2	12	26
MODE C	55	122	170	37	37	57
CROSS-LINKED		35			47	

UNUSED TARGET REPORTS	57	61	65	103	104	105
RADAR	50	50	50	100	100	100
BEACON	7	11	15	3	4	5

APPENDIX J

IAC SYSTEM LOAD FACTORS FOR THE
DETROIT TRACON SURVEILLANCE SITE

SYSTEM LOAD VALUES
FOR
DETROIT METRO WAYNE
1977

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	131.44	309.44	487.45	54.76	74.19	114.85
RADAR ONLY	38.65	92.16	145.66	4.86	11.20	17.53
BEACON ONLY	10.77	25.61	40.45	3.04	7.03	11.03
DISCRETE	.59	1.36	2.12	1.76	4.06	6.37
NON DISCRETE	10.18	24.25	38.32	1.28	2.97	4.66
MODE C	2.68	6.34	9.99	1.17	2.68	4.20
RADAR REINFORCED BEACON	82.02	191.68	301.34	46.86	55.96	86.29
DISCRETE	27.74	27.74	32.75	36.99	38.70	59.32
NON DISCRETE	54.27	163.94	268.60	9.86	17.26	26.97
MODE C	29.92	59.56	92.53	40.25	40.25	48.33

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	182.45	363.34	544.24	154.11	176.48	217.39
RADAR ONLY	90.00	146.00	202.00	106.00	113.00	120.00
BEACON ONLY	17.00	41.00	65.00	5.00	12.00	18.00
DISCRETE	1.00	3.00	5.00	3.00	7.00	11.00
NON DISCRETE	16.00	38.00	60.00	2.00	5.00	7.00
MODE C	5.00	11.00	17.00	2.00	5.00	8.00
RADAR REINFORCED BEACON	75.45	176.34	277.24	42.11	51.48	79.39
DISCRETE	25.52	25.52	30.13	34.03	35.60	54.58
NON DISCRETE	49.93	150.82	247.11	9.08	15.88	24.81
MODE C	27.52	54.79	85.13	37.03	37.03	44.46

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		39			51	
RADAR ONLY		3			4	
BEACON ONLY		3			4	
DISCRETE		2			2	
NON DISCRETE		1			1	
MODE C		1			2	
RADAR REINFORCED BEACON		33			43	
DISCRETE		26			26	
NON DISCRETE		7			9	
MODE C		28			37	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	93	271	448	4	24	65
RADAR ONLY	39	97	155	3	9	17
BEACON ONLY	11	30	49	1	6	11
DISCRETE	0	0	1	0	3	6
NON DISCRETE	11	30	46	1	2	5
MODE C	3	8	13	1	2	4
RADAR REINFORCED BEACON	43	144	244	0	9	37
DISCRETE	0	0	4	0	2	21
NON DISCRETE	43	144	240	0	7	16
MODE C	0	27	57	0	0	7
CROSS-LINKED		0			0	
UNUSED TARGET REPORTS	54	50	64	102	103	104
RADAR	50	50	50	100	100	100
BEACON	4	9	14	2	3	4

SYSTEM LOAD VALUES
FOR
DETROIT METRO WAYNE
1980

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	150.10	345.98	541.64	61.26	85.65	131.20
RADAR ONLY	39.40	92.55	145.70	4.44	10.45	15.65
REACCN ONLY	12.65	29.43	46.20	3.59	8.12	12.65
DISCRETE	.71	1.58	2.44	2.14	4.81	7.48
NON DISCRETE	11.94	27.85	43.76	1.45	3.31	5.16
MODE C	4.16	9.62	15.07	1.62	3.61	5.61
RADAR REINFORCED REACCN	98.05	224.00	349.95	53.23	67.49	102.90
DISCRETE	33.27	33.27	39.84	44.36	48.18	72.92
NON DISCRETE	64.78	190.73	310.11	8.87	19.30	29.98
MODE C	39.94	87.60	135.25	47.62	67.62	63.86

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	202.21	401.08	599.96	160.97	168.09	234.67
RADAR ONLY	92.00	148.00	204.00	106.00	112.00	119.00
REACCN ONLY	20.00	47.00	74.00	6.00	14.00	21.00
DISCRETE	2.00	4.00	6.00	4.00	9.00	13.00
NON DISCRETE	18.00	43.00	68.00	2.00	5.00	8.00
MODE C	7.00	17.00	26.00	3.00	7.00	11.00
RADAR REINFORCED REACCN	90.21	206.08	321.96	48.97	62.49	94.67
DISCRETE	30.61	30.61	36.65	40.81	44.33	67.09
NON DISCRETE	59.60	175.47	285.30	8.16	17.76	27.58
MODE C	36.75	80.59	124.43	43.81	43.81	58.75

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		44			57	
RADAR ONLY		3			4	
REACCN ONLY		4			4	
DISCRETE		3			3	
NON DISCRETE		1			1	
MODE C		1			2	
RADAR REINFORCED REACCN		37			49	
DISCRETE		31			41	
NON DISCRETE		6			8	
MODE C		33			44	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	108	302	498	5	29	74
RADAR ONLY	40	99	157	3	9	16
REACCN ONLY	14	34	56	2	7	12
DISCRETE	0	0	1	1	4	7
NON DISCRETE	14	34	55	1	3	7
MODE C	5	12	19	2	4	6
RADAR REINFORCED REACCN	54	169	285	0	13	46
DISCRETE	0	0	6	0	3	25
NON DISCRETE	54	169	279	0	10	20
MODE C	4	48	91	0	0	15
CROSS-LINKED		0			0	
UNUSED TARGET REPORTS	54	60	66	102	103	105
RADAR	50	50	50	100	100	100
REACCN	4	10	16	2	3	5

SYSTEM LOAD VALUES
FOR
DETROIT METRO WAYNE
1982

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	157.28	361.35	565.43	65.10	38.59	135.81
RADAR ONLY	37.45	87.44	137.42	4.18	9.41	14.63
BEACON ONLY	13.92	32.33	50.73	3.92	8.84	13.75
DISCRETE	.91	2.01	3.12	2.35	5.27	8.20
NON DISCRETE	13.02	30.31	47.61	1.57	3.56	5.55
MODE C	5.20	12.01	18.81	1.94	4.32	6.71
RADAR REINFORCED BEACON	105.91	241.59	377.27	57.00	70.35	107.43
DISCRETE	36.58	86.58	133.10	48.77	48.77	75.36
NON DISCRETE	69.33	205.01	334.17	8.23	21.57	32.07
MODE C	46.35	102.59	158.82	53.12	53.12	68.76
ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	209.43	418.26	625.69	164.44	190.72	238.84
RADAR ONLY	90.00	144.00	197.00	105.00	112.00	118.00
BEACON ONLY	22.00	52.00	81.00	7.00	14.00	22.00
DISCRETE	2.00	4.00	7.00	4.00	9.00	14.00
NON DISCRETE	20.00	48.00	74.00	3.00	5.00	8.00
MODE C	9.00	20.00	32.00	4.00	8.00	12.00
RADAR REINFORCED BEACON	97.43	222.26	347.69	52.44	64.72	98.84
DISCRETE	33.65	33.65	39.65	44.87	44.87	69.33
NON DISCRETE	63.78	188.61	307.64	7.57	19.85	29.50
MODE C	42.64	94.38	146.12	48.87	48.87	63.26
ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		46			62	
RADAR ONLY		3			4	
BEACON ONLY		3			5	
DISCRETE		3			4	
NON DISCRETE		0			1	
MODE C		1			2	
RADAR REINFORCED BEACON		40			53	
DISCRETE		34			45	
NON DISCRETE		6			8	
MODE C		37			49	
UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	113	316	520	3	26	74
RADAR ONLY	39	94	150	2	8	15
BEACON ONLY	16	39	63	1	6	13
DISCRETE	0	0	2	0	3	7
NON DISCRETE	16	39	61	1	3	6
MODE C	6	15	24	2	4	7
RADAR REINFORCED BEACON	58	183	307	0	12	46
DISCRETE	0	0	6	0	0	24
NON DISCRETE	58	183	301	0	12	22
MODE C	6	57	109	0	0	14
CROSS-LINKED		0			0	
UNUSED TARGET REPORTS	55	61	67	102	163	105
RADAR	50	50	50	100	100	100
BEACON	5	11	17	2	3	5

SYSTEM LOAD VALUES
FOR
DETROIT METRO WAYNE
1984

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	166.59	377.45	588.31	67.60	93.48	142.60
RADAR ONLY	36.65	84.47	132.28	3.90	8.65	13.39
BEACON ONLY	15.11	34.60	54.09	4.26	9.47	14.67
DISCRETE	1.12	2.44	3.77	2.57	5.67	8.78
NON DISCRETE	13.99	32.15	50.32	1.69	3.79	5.89
MODE C	6.13	13.96	21.80	2.23	4.90	7.57
RADAR REINFORCED BEACON	114.82	258.38	401.94	59.44	75.37	114.54
DISCRETE	39.12	39.12	48.69	52.16	52.16	80.63
NON DISCRETE	75.70	219.26	353.25	7.28	23.21	33.91
MODE C	53.65	117.42	181.20	56.51	56.51	75.78

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	219.64	433.71	648.78	166.68	195.34	246.38
RADAR ONLY	90.00	141.00	193.00	105.00	111.00	117.00
BEACON ONLY	24.00	55.00	86.00	7.00	15.00	24.00
DISCRETE	2.00	5.00	8.00	5.00	10.00	15.00
NON DISCRETE	22.00	50.00	78.00	2.00	5.00	9.00
MODE C	10.00	23.00	36.00	4.00	9.00	14.00
RADAR REINFORCED BEACON	105.64	237.71	369.78	54.68	69.34	105.38
DISCRETE	35.99	35.99	44.79	47.99	47.99	74.18
NON DISCRETE	69.65	201.72	324.99	6.70	21.35	31.19
MODE C	49.36	108.03	166.70	51.99	51.99	69.72

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		47			63	
RADAR ONLY		3			3	
BEACON ONLY		3			5	
DISCRETE		3			4	
NON DISCRETE		0			1	
MODE C		2			2	
RADAR REINFORCED BEACON		41			55	
DISCRETE		36			48	
NON DISCRETE		5			7	
MODE C		39			52	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	120	331	541	5	31	79
RADAR ONLY	38	92	145	3	9	15
BEACON ONLY	17	42	67	2	6	14
DISCRETE	0	1	3	1	4	8
NON DISCRETE	17	41	64	1	4	6
MODE C	6	17	27	2	5	9
RADAR REINFORCED BEACON	65	197	329	0	14	50
DISCRETE	0	0	9	0	0	26
NON DISCRETE	65	197	320	0	14	24
MODE C	10	69	128	0	0	18
CROSS-LINKED		0			0	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	55	62	68	103	163	105
RADAR	50	50	50	100	100	100
BEACON	5	12	18	3	3	5

SYSTEM LOAD VALUES
FOR
DETROIT METRO WAYNE
1986

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	174.43	389.55	604.70	70.40	97.07	147.31
RADAR ONLY	35.33	80.31	125.29	3.55	7.74	11.94
BEACON ONLY	16.17	36.51	56.84	4.56	9.97	15.38
DISCRETE	1.32	2.85	4.38	2.76	5.99	9.23
NON DISCRETE	14.85	33.65	52.45	1.81	3.98	6.15
MODE C	7.25	16.29	25.33	2.54	5.51	8.48
RADAR REINFORCED BEACON	122.90	272.73	422.57	62.28	79.36	119.99
DISCRETE	41.69	41.99	53.80	55.99	55.99	84.68
NON DISCRETE	80.90	230.74	368.77	6.29	23.37	35.31
MODE C	62.13	134.60	207.68	60.34	60.34	82.48

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	228.06	446.92	666.77	170.30	200.01	251.39
RADAR ONLY	89.00	138.00	187.00	105.00	111.00	116.00
BEACON ONLY	26.00	58.00	91.00	8.00	16.00	25.00
DISCRETE	3.00	6.00	9.00	5.00	11.00	16.00
NON DISCRETE	23.00	52.00	82.00	3.00	5.00	9.00
MODE C	12.00	27.00	42.00	5.00	10.00	15.00
RADAR REINFORCED BEACON	113.06	250.92	388.77	57.30	73.01	110.39
DISCRETE	38.63	38.63	49.49	51.51	51.51	77.91
NON DISCRETE	74.43	212.28	339.27	5.79	21.50	32.48
MODE C	57.16	123.83	190.51	55.51	55.51	75.88

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		48			65	
RADAR ONLY		2			3	
BEACON ONLY		3			4	
DISCRETE		3			4	
NON DISCRETE		0			0	
MODE C		2			2	
RADAR REINFORCED BEACON		43			58	
DISCRETE		39			52	
NON DISCRETE		4			6	
MODE C		42			56	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	126	342	556	6	32	83
RADAR ONLY	38	89	140	3	8	14
BEACON ONLY	18	45	71	3	9	17
DISCRETE	3	2	4	1	4	9
NON DISCRETE	18	43	67	2	5	8
MODE C	8	20	32	3	6	10
RADAR REINFORCED BEACON	70	208	345	0	15	52
DISCRETE	3	0	10	0	0	26
NON DISCRETE	70	208	335	0	15	26
MODE C	15	82	149	0	0	20
CROSS-LINKED		0			0	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	56	62	69	103	104	105
RADAR	50	50	50	100	100	100
BEACON	6	12	19	3	4	5

SYSTEM LOAD VALUES
FOR
DETROIT METRO WAYNE
1988

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	181.97	400.45	618.94	73.53	100.72	152.00
RADAR ONLY	32.19	72.15	112.11	3.17	6.79	10.41
BEACON ONLY	17.45	38.82	60.19	4.88	10.49	16.11
DISCRETE	1.56	3.31	5.07	2.95	6.31	9.67
NON DISCRETE	15.88	35.50	55.12	1.93	4.18	6.44
MODE C	8.42	18.65	28.88	2.87	6.13	9.39
RADAR REINFORCED BEACON	132.33	289.48	446.64	65.48	83.44	125.48
DISCRETE	45.64	45.64	59.81	60.85	60.85	78.49
NON DISCRETE	86.69	243.84	386.83	4.63	22.59	36.99
MODE C	70.87	151.74	232.61	66.29	66.29	89.63
ADJUSTED						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	235.74	459.32	681.91	173.24	203.77	256.44
RADAR ONLY	86.00	131.00	175.00	105.00	110.00	115.00
BEACON ONLY	28.00	62.00	96.00	8.00	17.00	26.00
DISCRETE	3.00	7.00	10.00	5.00	11.00	17.00
NON DISCRETE	25.00	55.00	86.00	3.00	6.00	9.00
MODE C	14.00	31.00	47.00	5.00	11.00	17.00
RADAR REINFORCED BEACON	121.74	266.32	410.91	60.24	76.77	115.44
DISCRETE	41.99	41.99	55.63	55.98	55.98	81.41
NON DISCRETE	79.75	224.34	355.88	4.26	20.78	34.63
MODE C	65.20	139.60	214.00	60.98	60.98	81.91
ASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		51			68	
RADAR ONLY		2			3	
BEACON ONLY		4			5	
DISCRETE		4			5	
NON DISCRETE		0			0	
MODE C		2			2	
RADAR REINFORCED BEACON		45			60	
DISCRETE		42			56	
NON DISCRETE		3			4	
MODE C		46			61	
UNASSOCIATED TRACKS						
	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	131	349	568	5	33	83
RADAR ONLY	35	82	128	3	7	12
BEACON ONLY	19	46	74	2	9	16
DISCRETE	0	1	3	0	4	8
NON DISCRETE	19	45	71	2	5	8
MODE C	9	23	36	4	7	11
RADAR REINFORCED BEACON	77	221	366	0	17	55
DISCRETE	0	0	13	0	0	25
NON DISCRETE	77	221	353	0	17	30
MODE C	19	94	152	0	0	21
CROSS-LINKED		0			0	
UNUSED TARGET REPORTS						
	56	63	70	103	104	106
RADAR	50	50	50	100	100	100
BEACON	6	13	20	3	4	6

SYSTEM LOAD VALUES
FOR
DETROIT METRO WAYNE
1990

BASE	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	186.00	405.47	624.93	76.46	103.40	155.72
RADAR ONLY	29.67	65.83	101.99	2.64	5.62	8.60
BEACON ONLY	17.98	39.76	61.34	4.98	10.67	16.35
DISCRETE	1.74	3.68	5.63	3.03	6.45	9.87
NON DISCRETE	16.24	36.08	55.91	1.95	4.21	6.47
MODE C	9.37	20.64	31.92	3.11	6.60	10.10
RADAR REINFORCED BEACON	138.35	299.88	461.41	68.84	87.12	130.78
DISCRETE	49.54	49.54	66.07	66.05	66.05	92.87
NON DISCRETE	88.81	250.34	395.34	2.78	21.06	37.91
MODE C	79.01	168.22	257.43	71.49	71.49	96.39

ADJUSTED	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	240.28	464.89	688.50	175.33	207.15	260.32
RADAR ONLY	84.00	125.00	166.00	104.00	109.00	113.00
BEACON ONLY	29.00	64.00	98.00	8.00	18.00	27.00
DISCRETE	4.00	7.00	11.00	6.00	11.00	17.00
NON DISCRETE	25.00	57.00	87.00	2.00	7.00	10.00
MODE C	16.00	34.00	53.00	6.00	12.00	18.00
RADAR REINFORCED BEACON	127.28	275.89	424.50	63.33	86.15	120.32
DISCRETE	45.58	45.58	60.78	60.77	60.77	85.44
NON DISCRETE	81.70	230.31	363.72	2.56	19.38	34.88
MODE C	72.69	154.76	236.84	65.77	65.77	88.68

ASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL		54			72	
RADAR ONLY		2			3	
BEACON ONLY		4			5	
DISCRETE		4			5	
NON DISCRETE		0			0	
MODE C		2			3	
RADAR REINFORCED BEACON		48			64	
DISCRETE		46			61	
NON DISCRETE		2			3	
MODE C		50			66	

UNASSOCIATED TRACKS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
TOTAL	133	352	571	5	31	84
RADAR ONLY	33	76	118	2	6	11
BEACON ONLY	20	48	76	3	9	17
DISCRETE	0	2	4	1	4	9
NON DISCRETE	20	46	72	2	5	8
MODE C	11	25	40	3	6	11
RADAR REINFORCED BEACON	80	228	377	0	16	56
DISCRETE	0	0	15	0	0	24
NON DISCRETE	80	228	362	0	16	32
MODE C	23	105	187	0	0	23
CROSS-LINKED		0			0	

UNUSED TARGET REPORTS	GOOD WEATHER			BAD WEATHER		
	A	B	C	A	B	C
RADAR	50	50	50	100	100	100
BEACON	6	14	21	3	4	6

APPENDIX K

RESULTS OF MEASUREMENTS OF PROCESSING TIMES AT THE
NEW YORK TRACON AND THE SYSTEM SIMULATION FACILITY

NOTE: Results of the following test runs are included
in this Appendix:

NY
SSF

ARTS IIIA MEASUREMENT DATA TAKEN
AT NY TRACON

RUN #	DATE	SCENARIO	NOTES
1	7/3/79	Capacity	
2	7/3/79	Live	All Targets Unassociated
3	7/3/79	Live	Some Associated Targets
5	7/4/79	Modified Capacity	All Tracks Unassociated No Keyboard Entries
6	7/4/79	Modified Capacity	Some Associated Tracks Keyboard Entries Enabled
7	7/5/79	Modified Capacity	
8	7/4/79	Sterling Scenario	

ARTS IIIA MEASUREMENT DATA TAKEN

AT SSF

RUN #	DATE	SCENARIO	NOTES
9	9/4/79	Modified Capacity	7 Processors, 46 Displays
10	9/4/79	Modified Capacity	7 Processors, 38 Displays
11	9/4/79	Modified Capacity	7 Processors, 32 Displays
12	9/4/79	Modified Capacity	7 Processors, 20 Displays
13	9/4/79	Modified Capacity	5 Processors, 46 Displays
14	9/4/79	Modified Capacity	5 Processors, 20 Displays

- RUN 1 -
TASK TIMING STATISTICS

PLANNED TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	1516	3	0	10	1	3
AOB	380	1	0	6	0	0
CDRC	380	1	1	5	0	0
CRITI	380	3	0	93	12	164
DOP	380	15	8	25	2	4
IFI	379	1	0	9	0	0
IFO	380	10	6	18	1	2
KOFA	379	4	3	11	1	1
NAT	379	1	0	7	1	1
MSAW	1516	2	1	9	1	1
MTI	379	1	0	9	0	0
PAUS	1137	27	0	65	15	225
PAUS1	758	33	6	63	11	132
PAUS2	758	29	7	65	12	146
PDOP	379	14	0	49	16	280
RDOP	379	16	12	24	1	3
RKIP	379	8	5	15	1	3
RTDOP	379	5	4	9	1	1
SCIME	1137	2	0	32	2	6
SLINK	379	10	5	22	2	7
SNABS	1516	1	0	5	0	0
TCRSS	1516	9	0	39	7	49
TDOP	1137	8	5	15	1	2
TDOP1	758	8	6	15	1	1
TEDC	1516	15	0	64	13	190
TEXEC	380	2	1	11	1	1
TINIT	760	4	0	25	4	16
TINT1	759	3	1	24	3	9
TPRED	1516	12	0	35	7	63
TPSEC	1516	8	0	32	5	31
TPUR	1516	5	0	57	8	66
TROUT	759	4	1	13	1	3
TROUT	759	3	0	12	1	3
TUDS	380	6	1	22	6	40
TUD	380	1	1	7	1	1

- RUN 1 -

PROCESSOR UTILIZATION FOR PLANNED TASK

PROCESSOR	# RUNS	AVERAGE TIME		MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
		PER TASK(MILS)					
0	4107	8		0	85	10	111
1	3488	9		0	93	11	132
2	4122	8		0	65	10	106
3	4012	8		0	84	10	111
4	3853	8		0	85	10	112
5	3825	8		0	85	10	115
6	3895	8		0	83	10	111
TOTAL	27302	8					

- RUN 1 -

TASK TIMING STATISTICS

POPUP TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
CDT	72	4	2	11	1	3
CTIP	83	2	1	4	0	0
EDISC	1703	4	1	94	6	37
IFI	3	1	1	1	0	0
KIP	635	38	29	59	5	29
PSRAP	585	9	1	24	4	17

PROCESSOR UTILIZATION FOR POPUP TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	488	11	1	82	13	194
1	412	14	0	94	16	263
2	468	11	1	82	13	177
3	432	12	1	86	13	189
4	434	12	0	51	13	194
5	425	12	0	87	15	235
6	422	11	0	84	13	186
TOTAL	3081	12				

- RUN 1 -

PERCENT OF PROCESSING TIME DISTRIBUTION

PROCESSOR	PLANNED	POUP	DEAD	INACTIVE	IDLE	OVERHEAD
0	74.855	12.599	.998	3.451	.000	8.091
1	74.816	13.250	.642	3.597	.000	7.687
2	74.650	12.419	.890	3.384	.000	8.648
3	75.191	11.927	1.048	3.494	.000	8.332
4	75.167	12.464	.791	3.656	.000	7.914
5	75.076	12.308	.798	3.748	.000	8.064
6	76.722	10.943	.921	3.445	.000	7.960

Average Lattice Time = 112.3

$\sigma = 20.7$

- RUN 2 -

TASK TIMING STATISTICS

PLANNED TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	2625	2	0	12	1	2
AOM	656	1	0	8	0	0
CDRC	657	1	1	5	0	0
CRITI	657	1	0	6	0	0
DOP	657	13	5	23	2	5
IFI	656	1	0	8	0	0
IFO	656	7	1	16	1	1
KOFA	656	4	3	10	1	1
MAT	656	1	0	8	0	0
MSAM	2624	1	0	10	0	0
MTI	656	1	0	7	0	0
PAUS	1968	14	0	51	10	117
PAUS1	1312	18	1	49	8	77
PAUS2	1312	14	0	47	9	90
PDP	657	6	0	31	7	62
RDOP	657	14	3	22	4	19
RKIP	657	7	3	17	1	3
RTDOP	656	2	1	9	1	1
SCTME	1968	1	0	18	1	1
SLINK	656	1	1	9	1	1
SWABS	2624	1	0	6	0	0
TCRSS	2624	8	0	58	9	84
TDOP	1968	3	1	11	1	1
TDOP1	1312	3	2	7	0	0
TEDC	2625	3	0	30	3	15
TEVEC	657	2	1	12	1	1
TINT	1313	3	0	23	2	8
TINT1	1312	2	1	25	2	5
TPRED	2624	6	0	36	5	35
TPSEC	2624	7	0	44	7	58
TPUR	2624	14	0	115	20	417
TROUT	1312	3	0	10	1	2
TROUT1	1312	2	0	11	1	2
TURS	657	9	1	24	6	44
TUD	657	7	1	25	7	51

- RUN 2 -
PROCESSOR UTILIZATION FOR PLANNED TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	6932	5	0	100	8	64
1	6138	6	0	103	8	74
2	6919	5	0	103	8	66
3	6996	5	0	104	8	69
4	6562	6	0	111	8	79
5	7029	5	0	115	7	63
6	6658	6	0	111	8	77
TOTAL	47244	6				

- RUN 2 -
TASK TIMING STATISTICS

POPU TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
CDT	21	2	1	4	1	1
CTIP	112	1	1	3	0	0
EDISC	602	3	1	8	1	1
IFI	3	1	1	1	0	0
KIP	876	39	31	61	4	24
MSP	18	4	1	10	2	7
PSRAP	798	20	7	43	7	50

PROCESSOR UTILIZATION FOR POPUP TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	445	21	1	48	14	223
1	332	25	1	61	18	328
2	371	21	0	48	15	227
3	328	21	0	53	15	231
4	324	21	1	53	15	241
5	302	21	0	51	15	233
6	328	22	0	53	15	243
TOTAL	2430	22				

- RUN 2 -

PERCENT OF PROCESSING TIME DISTRIBUTION

PROCESSOR	PLANNED	POPIP	DEAD	INACTIVE	IDLE	OVERHEAD
0	61.580	16.492	2.037	8.701	.000	11.185
1	63.521	14.220	1.837	8.714	.000	11.699
2	63.955	13.777	1.929	8.820	.000	11.509
3	65.390	11.966	1.867	9.242	.000	11.529
4	65.859	12.076	2.017	8.638	.000	11.404
5	66.220	10.791	1.708	9.117	.000	12.160
6	65.666	12.607	1.691	8.503	.000	11.527

Average Lattice Time = 87.3

- RUN 3 -

TASK TIMING STATISTICS

PLANNED TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	3060	2	0	11	1	2
AOB	765	1	0	9	1	1
CDRC	766	1	1	7	0	0
CRIT1	765	14	5	6	0	0
DOP	765	1	0	23	2	4
IFI	765	7	0	10	0	0
IFO	765	4	2	15	1	1
KOFA	765	4	3	46	2	5
MAT	765	1	0	10	1	1
MSAW	3060	2	1	10	1	1
MT1	765	1	0	8	0	0
PAUS	2295	14	0	51	10	114
PAUS1	1530	17	1	47	8	77
PAUS2	1530	14	0	50	9	84
PIDP	766	6	0	34	8	65
RDOP	765	14	3	22	4	17
RKLP	766	7	3	18	1	3
RTDOP	765	2	1	6	1	1
SCTHE	2295	1	0	13	1	2
SLINK	765	8	1	53	9	93
SWABS	3060	1	0	10	0	0
TCRSS	3060	7	0	52	8	80
TDOP	2295	4	2	39	2	5
TDOP1	1530	4	2	26	1	3
TEDC	3060	2	0	21	2	5
TESEC	765	2	1	14	1	1
TINIT	1532	3	0	35	2	8
TINT1	1531	2	0	20	2	4
TPRED	3060	5	0	40	5	32
TPSEC	3060	7	0	47	7	57
TPUR	3060	12	0	111	19	370
TROUT	1531	3	0	10	1	2
TROUT1	1531	2	0	9	1	1
TUDS	766	9	0	22	6	44
TUD	765	7	1	24	7	49

- RUN 3 -

PROCESSOR UTILIZATION FOR PLANNED TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	8067	5	0	101	7	60
1	6993	6	0	105	8	69
2	8212	5	0	105	7	63
3	8113	5	0	106	8	66
4	7994	5	0	106	8	66
5	7848	6	0	110	8	71
6	7863	5	0	111	8	64
TOTAL	55090	5				

AD-A087 243

STERLING SYSTEMS INC WASHINGTON DC

F/8 17/7

ASSESSMENT OF THE CAPACITY OF THE AUTOMATED RADAR TERMINAL SYST--ETC(U)

JUN 80 W PAILEN, H C WINTERMOYER, R SITTLER

DOT-FA78WAI-942

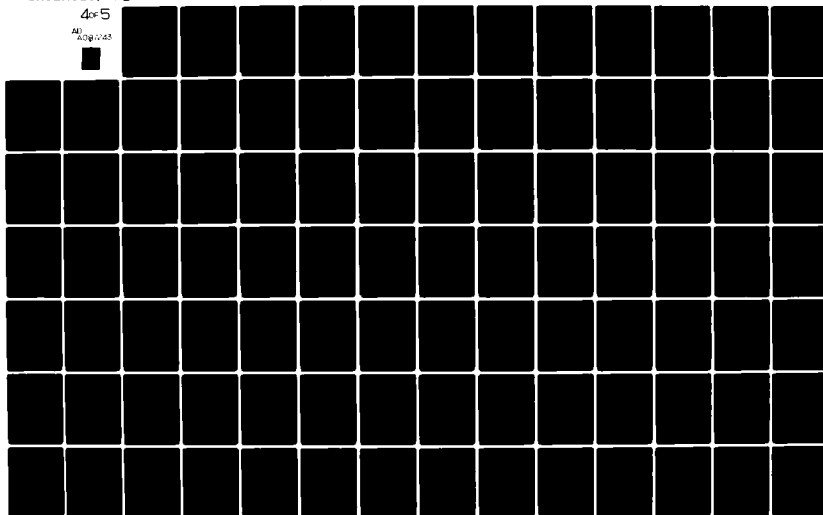
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- RUN 3 -

TASK TIMING STATISTICS

POPIR TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
CDT	58	4	2	10	1	3
CTIP	129	2	1	4	0	0
EDISC	701	3	1	10	1	1
IFI	3	1	1	1	0	0
KIP	1011	39	30	56	4	22
PSRAP	921	19	6	42	5	33

PROCESSOR UTILIZATION FOR POPIR TASK

PROCESSOR	# RUNS PER TASK(MILS)	AVERAGE TIME	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	498	22	1	46	14	207
1	409	24	0	56	17	304
2	407	19	1	49	14	205
3	389	19	0	49	14	200
4	372	20	1	48	14	224
5	375	19	0	47	14	209
6	373	21	0	54	15	251
TOTAL	2823	21				

- RUN 3 -
PERCENT OF PROCESSING TIME DISTRIBUTION

PROCESSOR	PLANNED	POPIUP	DEAD	INACTIVE	IDLE	OVERHEAD
0	61.585	16.833	1.894	9.089	.000	10.589
1	62.923	15.089	1.658	9.175	.000	11.146
2	65.640	11.808	1.830	9.466	.000	11.248
3	65.791	11.179	1.765	9.628	.000	11.628
4	65.687	11.044	1.857	9.789	.000	11.615
5	66.072	11.000	1.730	9.460	.000	11.732
6	65.230	11.947	1.791	9.916	.000	11.109

Average Lattice Time = .86

- RUN 5 -

TASK TIMING STATISTICS

PLANNED TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	1668	2	0	9	1	3
AQB	417	1	0	7	0	0
CDRC	417	1	1	4	0	0
CRIT1	417	3	0	76	10	114
DOP	417	13	4	24	1	3
IFI	417	1	0	5	0	0
IFO	417	9	1	17	1	2
KOFA	417	4	3	9	1	1
MAT	417	1	0	19	1	1
MSAW	1668	2	1	8	1	1
MT1	417	1	0	5	0	0
PAUS	1251	20	0	179	18	326
PAUS1	834	26	0	128	15	229
PAUS2	834	20	0	133	16	271
PDDP	417	8	0	33	9	99
RDDP	417	15	3	21	2	6
RKIP	417	8	4	14	1	2
RTDOP	417	4	2	7	1	1
SCTME	1251	1	0	14	1	3
SLINK	417	7	3	44	4	19
SWABS	1668	1	0	8	0	0
TCRSS	1668	7	0	39	6	48
TDOP	1251	7	5	16	1	2
TDOP1	834	7	5	27	1	2
TEDC	1668	12	0	65	14	212
TEXEC	417	2	1	9	1	1
TINT1	834	5	0	23	4	24
TINT2	834	3	0	29	3	14
TPRED	1668	8	0	39	7	54
TPSEC	1668	7	0	28	5	30
TPUR	1668	3	0	64	5	35
TROUT	834	3	0	11	1	2
TROU1	834	3	0	9	1	2
TUDS	417	8	1	20	6	43
TUD	417	3	1	22	4	21

- RUN 5 -

PROCESSOR UTILIZATION FOR PLANNED TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	4251	6	0	122	9	89
1	3756	7	0	128	9	97
2	4404	6	0	133	9	85
3	4549	6	0	179	9	91
4	4355	6	0	97	9	86
5	4424	7	0	140	9	92
6	4285	7	0	124	9	89
TOTAL	30024	7				

- RUN 5 -
TASK TIMING STATISTICS

POPUP TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
CDT	24	4	2	7	1	2
CTIP	84	2	1	4	0	0
EDISC	1795	4	1	99	6	37
IFI	3	1	1	2	1	1
KIP	646	38	30	61	5	25
PSRAP	295	143	69	261	36	1361

PROCESSOR UTILIZATION FOR POPUP TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	466	25	1	234	42	1811
1	374	33	1	261	54	2970
2	392	27	0	202	43	1930
3	398	24	0	218	41	1712
4	411	26	0	237	42	1824
5	406	24	0	223	39	1566
6	400	27	0	222	43	1915
TOTAL	2847	26				

- RUN 5 -

PERCENT OF PROCESSING TIME DISTRIBUTION

PROCESSOR	PLANNED	POPIP	DEAD	INACTIVE	IDLE	OVERHEAD
0	62.585	26.242	.859	2.625	.000	7.683
1	60.894	28.273	.521	2.490	.000	7.818
2	64.408	23.960	.830	2.832	.000	7.964
3	66.281	21.871	.792	2.482	.000	8.566
4	64.380	24.103	.849	2.312	.000	8.349
5	66.546	22.072	.482	2.558	.000	8.335
6	64.457	24.285	.654	2.353	.000	8.244

Average Lattice Time = 104.3

- RUN 6 -
TASK TIMING STATISTICS

PLANNED TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	3516	2	0	16	1	3
AQ0	879	1	0	6	0	0
CDRC	878	1	1	6	0	0
CRIT1	879	3	0	86	10	109
DOP	878	14	5	23	1	3
IFI	879	1	0	5	0	0
IFO	879	9	3	16	1	1
KOFA	879	4	3	11	1	1
MAT	879	1	0	18	1	1
MSAW	3516	2	1	9	1	1
MT1	879	1	0	4	0	0
PAUS	2637	20	0	70	15	225
PAUS1	1758	24	1	71	13	174
PAUS2	1758	21	1	70	13	170
PDOP	879	6	1	32	7	63
RDOP	879	15	3	23	3	11
RKIP	878	8	4	18	1	3
RTDOP	879	4	3	9	1	1
SCTHE	2637	1	0	16	2	4
SLINK	879	8	3	31	4	19
SWABS	3516	1	0	10	0	0
TCRSS	3516	6	0	42	7	49
TDOP	2637	7	5	16	1	2
TDOP1	1758	7	5	13	1	1
TEDC	3516	10	0	66	13	189
TEJEC	879	2	1	13	1	2
TINIT	1758	5	0	40	5	31
TINT1	1758	3	0	30	3	15
TPRED	3516	8	0	49	8	71
TPSEC	3516	6	0	34	5	34
TPUR	3516	2	0	64	4	23
TROUT	1758	3	0	13	1	3
TROUT1	1758	3	0	10	1	2
TUDS	878	7	1	21	6	43
TUD	879	3	1	20	4	17

- RUN 6 -

PROCESSOR UTILIZATION FOR PLANNED TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	9355	6	0	78	8	77
1	8159	7	0	86	9	89
2	9462	6	0	76	8	77
3	9361	6	0	74	8	76
4	8919	7	0	77	8	79
5	9011	6	0	76	8	80
6	9017	6	0	76	8	78
TOTAL	63284	6				

- RUN 6 -

TASK TIMING STATISTICS

POPUP TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
CDT	84	4	2	12	1	3
CTIP	159	2	1	4	0	0
EDISC	3319	4	1	94	5	34
IFI	3	1	1	1	0	0
KIP	1214	40	30	63	5	31
PSRAP	1123	7	1	28	3	15

PROCESSOR UTILIZATION FOR POPUP TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	1003	71	0	85	14	202
1	810	14	0	94	17	312
2	871	11	1	89	14	200
3	832	12	1	86	14	214
4	813	12	1	88	14	214
5	771	12	0	92	15	226
6	802	12	0	84	15	227
TOTAL	5902	12				

- RUN 6 -

PERCENT OF PROCESSING TIME DISTRIBUTION

PROCESSOR	PLANNED	POPU	DEAD	INACTIVE	IDLE	OVERHEAD
0	69.187	13.925	1.933	4.283	.000	10.666
1	69.871	13.904	1.498	4.087	.000	10.634
2	70.974	12.130	1.800	4.294	.000	10.794
3	71.388	11.958	1.871	4.273	.000	10.503
4	71.197	12.343	1.830	4.083	.000	10.539
5	71.792	11.353	1.619	4.050	.000	11.179
6	71.667	11.796	1.750	4.433	.000	10.347

Average Lattice Time = 92.7

- RUN 7 -

TASK TIMING STATISTICS

PLANNED TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	2428	2	0	12	1	3
AOP	607	1	0	4	0	0
CDRC	607	1	1	6	0	0
CRIT1	607	3	1	82	9	99
DOP	607	14	7	26	1	3
IF1	607	1	0	5	0	0
IFO	607	9	2	17	1	1
KOFA	607	6	3	51	7	49
MAT	607	2	0	18	3	9
MSAM	2428	2	1	10	1	1
MT1	607	1	0	5	0	0
PAUS	1821	23	0	68	14	224
PAUS1	1214	28	5	65	12	155
PAUS2	1214	25	1	62	12	159
PDOF	607	11	0	47	13	194
RQOP	607	16	3	23	2	7
RKIP	607	8	4	17	1	3
RTDOP	607	4	2	8	1	1
SCIME	1821	2	0	27	1	3
SLINK	607	7	3	35	5	27
SWABS	2428	1	0	8	0	0
TCRSS	2428	7	0	42	7	53
TDOP	1821	6	4	28	1	2
TDOP1	1214	6	4	28	1	2
TEEC	2428	12	0	65	14	200
TEXC	608	2	1	11	1	1
TINT	1214	4	1	24	3	10
TINT1	1214	3	0	21	2	7
TPRED	2428	9	0	47	8	65
TPSEC	2428	7	0	38	5	34
TPUR	2428	3	0	68	5	29
TROUT	1214	4	0	11	2	4
TROUT1	1214	3	0	11	1	2
TUDS	607	9	1	21	6	44
TUD	607	4	1	22	5	28

- RUN 7 -
PROCESSOR UTILIZATION FOR PLANNED TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	6549	7	0	69	9	89
1	5714	8	0	82	10	103
2	6387	7	0	70	9	92
3	6453	7	0	72	9	89
4	6255	7	0	69	9	92
5	6160	7	0	64	9	94
6	6187	7	0	65	9	94
TOTAL	43705	7				

- RUN 7 -

TASK TIMING STATISTICS

POPIP TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
CDT	84	3	2	9	1	2
CTIP	119	2	1	4	1	1
EDISC	2474	4	1	96	5	35
IF1	3	1	1	1	0	0
KIP	910	40	30	64	5	34
PSRAP	846	8	1	25	3	15

PROCESSOR UTILIZATION FOR POPIP TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	722	11	0	84	14	210
1	609	14	0	96	17	319
2	647	12	1	87	14	218
3	643	12	0	54	14	202
4	625	12	1	87	15	235
5	593	13	0	86	15	227
6	597	12	1	86	15	232
TOTAL	4436	12				

- RUN 7 -
PERCENT OF PROCESSING TIME DISTRIBUTION

PROCESSOR	PLANNED	POPIUP	DEAD	INACTIVE	IDLE	OVERHEAD
0	70.945	13.095	2.302	4.076	.000	9.574
1	70.097	13.787	2.132	4.037	.000	9.941
2	71.943	12.714	2.207	3.849	.000	9.281
3	71.687	12.421	2.218	3.990	.000	9.677
4	71.978	12.546	1.884	3.994	.000	9.591
5	72.080	12.292	1.992	3.876	.000	9.753
6	72.683	12.013	2.103	3.802	.000	9.392

Average Lattice Time = 100.7

- RUN 7 -

TASK TIMING STATISTICS
START TIME = 0:08:01.696
END TIME = 0:09:01.215

PLANNED TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	2568	2	0	12	1	3
ADP	643	1	0	8	0	0
CDRC	643	1	1	7	0	0
CRIT1	643	3	0	87	10	111
DOP	643	14	7	27	2	4
IFI	642	1	0	6	0	0
IFO	643	9	2	17	1	2
KOFA	642	4	3	11	1	1
KAT	643	1	0	21	1	1
MSAW	2568	2	0	14	1	1
MT1	642	1	0	5	0	0
PAUS	1926	20	0	100	15	244
PAUS1	1284	24	1	106	13	195
PAUS2	1284	22	1	90	13	193
PDOP	643	12	0	51	16	259
RDOP	642	15	3	22	3	11
RKTP	643	8	4	24	1	3
RTDOP	642	4	2	8	1	1
SCME	1926	1	0	18	2	4
SLINK	642	9	2	48	5	31
SWABS	2568	1	0	10	0	0
TCRSS	2568	7	0	46	7	51
TDOP	1926	8	4	18	1	2
TDOP1	1284	8	5	22	1	2
TEDC	2568	11	0	66	14	197
TEDEC	643	2	1	12	1	1
TINIT	1286	4	0	36	4	24
TINT1	1286	3	0	36	3	11
TPRED	2568	8	0	52	8	74
TPSEC	2568	6	0	26	5	33
TPUR	2568	2	0	47	4	20
TROUT	1286	4	0	12	1	3
TROUT1	1286	3	0	10	1	2
TUDS	643	7	1	22	6	46
TUD	643	3	1	25	4	21

- RUN 7 -
PROCESSOR UTILIZATION FOR PLANNED TASK
START TIME = 0:08:01.696
END TIME = 0:09:01.215

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	6768	6	0	80	9	85
1	6068	7	0	87	9	99
2	6985	6	0	100	9	82
3	6703	7	0	97	9	85
4	6665	7	0	91	9	85
5	6445	7	0	106	9	88
6	6609	7	0	90	9	83
TOTAL	46243	7				

- RUN 7 -

TASK TIMING STATISTICS
START TIME = 0:08:01.696
END TIME = 0:09:01.215

POPIR TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
CDT	90	3	2	10	1	2
CTIP	119	2	1	4	0	0
EDISC	2469	4	1	89	5	33
IFI	3	1	1	1	0	0
KIP	910	41	31	68	5	32
PSRAP	832	7	1	25	4	16
QLOOK	2	39	15	62	33	1104

PROCESSOR UTILIZATION FOR POPIR TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	727	12	0	83	15	248
1	614	14	0	68	17	315
2	693	11	0	87	14	204
3	588	12	0	50	14	213
4	608	13	0	89	16	264
5	587	13	0	58	15	242
6	608	12	0	86	15	243
TOTAL	4425	12				

- RUN 7 -
 PERCENT OF PROCESSING TIME DISTRIBUTION
 START TIME = 0:08:01.696
 END TIME = 0:09:01.215

PROCESSOR	PLANNED	POPUP	DEAD	INACTIVE	IDLE	OVERHEAD
0	69.898	14.597	1.558	3.736	.000	10.205
1	70.496	13.910	1.259	3.828	.000	10.501
2	71.316	12.460	1.427	4.244	.000	10.544
3	72.345	11.775	1.619	4.089	.000	10.166
4	71.435	12.646	1.566	4.113	.000	10.234
5	71.384	12.787	1.589	3.566	.000	10.667
6	71.792	12.193	1.472	4.269	.000	10.267

Average Lattice Time = 94.7

- RUN 8 -

TASK TIMING STATISTICS

PLANNED TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	432	1	0	8	1	1
ADP	109	1	1	9	1	1
CDRC	109	1	1	5	0	0
CRITI	109	2	1	75	7	50
DOP	109	11	4	25	4	16
IFI	108	1	1	6	1	1
IFO	109	9	3	15	1	1
KOFA	108	5	3	10	1	1
MAT	109	1	0	20	2	4
MSAW	432	1	0	8	0	0
MT1	109	1	0	6	1	1
PAUS	324	6	1	16	3	9
PAUS1	216	7	4	12	1	1
PAUS2	216	7	1	10	1	2
PDDP	109	4	0	21	5	25
RDDP	109	10	3	22	6	40
RKIP	109	5	3	13	1	2
RTDDP	108	4	3	10	1	1
SCTME	324	1	1	14	1	2
SLINK	108	6	5	12	1	2
SWABS	432	1	0	8	0	0
TCRSS	433	1	0	12	1	1
TDDP	324	10	6	18	3	9
TDDP1	216	10	5	18	3	10
TEDC	433	1	0	11	1	1
TEDEC	109	2	0	11	1	2
TIMIT	218	1	0	6	1	1
TINT1	218	1	0	5	0	0
TPRED	432	1	0	7	1	1
TPSEC	433	1	0	21	1	2
TPUR	432	1	0	7	1	1
TROUT	218	2	1	6	1	1
TROUL	218	1	0	6	0	0
TUOS	109	2	1	15	2	4
TUD	109	2	1	15	1	3

- RUN 8 -

PROCESSOR UTILIZATION FOR PLANNED TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	1176	3	0	20	3	11
1	1066	3	0	22	3	15
2	1160	3	0	16	3	10
3	1145	3	0	20	3	11
4	1029	4	0	75	4	20
5	1094	3	0	18	3	12
6	1130	3	0	25	3	12
TOTAL	7800	3				

- RUN 8 -
TASK TIMING STATISTICS

POPIR TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ANCTK	92	7	1	41	7	60
CDT	2	2	2	2	0	0
CTIP	12	2	1	2	0	0
EDISC	106	4	1	8	1	2
KTP	92	40	34	50	3	13
MSP	4	3	1	5	2	4
PSRAP	84	1	0	3	0	0

PROCESSOR UTILIZATION FOR POPIR TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	73	12	0	43	15	238
1	60	12	0	48	15	234
2	55	14	0	45	16	286
3	52	15	0	48	17	306
4	48	11	0	48	15	240
5	59	10	0	49	15	229
6	45	13	0	50	17	295
TOTAL	392	12				

- RUN 8 -

PERCENT OF PROCESSING TIME DISTRIBUTION

PROCESSOR	PLANNED	POPUP	DEAD	INACTIVE	IDLE	OVERHEAD
0	54.744	14.521	4.042	5.613	.000	21.072
1	57.552	11.595	3.275	5.246	.000	22.326
2	55.312	13.066	3.925	4.427	.000	23.261
3	55.414	12.732	3.826	4.394	.000	23.628
4	61.931	8.505	2.707	6.097	.000	20.753
5	58.238	9.826	3.341	5.263	.000	23.328
6	57.986	9.892	3.742	5.546	.000	22.826

Average Lattice Time = 54.7

- RUN 8 -

TASK TIMING STATISTICS

START TIME = 1:03:02.865

END TIME = 1:03:07.543

PLANNED TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	341	1	0	8	1	1
ADP	86	1	0	5	0	0
CDRC	86	1	1	8	1	1
CRIT1	86	2	1	76	8	66
DJP	86	11	4	20	3	14
IFT	85	1	1	5	0	0
IFO	86	9	8	17	1	2
KOFA	85	5	3	9	1	1
MAT	86	1	1	7	1	1
MSAW	341	1	0	7	0	0
MT1	86	1	1	4	0	0
PAUS	258	6	0	18	3	10
PAUS1	172	8	5	13	1	2
PAUS2	172	7	1	14	2	4
PDOP	86	3	1	20	4	23
RDOP	85	10	3	20	5	28
RKTP	86	5	3	16	1	3
RTDOP	85	4	3	7	1	1
SCTME	258	1	1	19	2	5
SLINK	85	6	5	12	1	3
SWABS	341	1	0	6	0	0
TCRSS	341	2	0	20	2	4
TDOP	255	10	5	17	3	10
TDOP1	170	10	5	16	3	10
TEDC	341	1	0	7	1	1
TEDEC	86	2	1	7	1	1
TINIT	172	1	0	6	0	0
TINT1	172	1	0	8	1	1
TPRED	340	2	0	21	1	3
TPSEC	341	2	0	26	2	7
TPUR	340	1	0	10	1	1
TROUT	172	2	1	7	1	1
TROUT1	172	1	1	5	0	0
TUDS	86	2	1	14	2	5
TUD	86	1	1	7	1	1

- RUN 8 -

PROCESSOR UTILIZATION FOR PLANNED TASK

START TIME = 1:03:02.865

END TIME = 1:03:07.543

PROCESSOR	AVERAGE TIME				MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
	# RUNS	PER TASK	(MILS)					
0	890	3		0	22	3	12	
1	856	3		0	21	3	14	
2	936	3		0	76	4	16	
3	884	3		0	26	3	13	
4	820	3		0	20	3	15	
5	875	3		0	20	3	14	
6	895	3		0	18	3	12	
TOTAL	6156	3						

- RUN 8 -

TASK TIMING STATISTICS
START TIME = 1:03:02.865
END TIME = 1:03:07.543

POPIUP TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ANCTK	73	13	1	81	16	279
CDT	1	2	2	2	1	1
CTIP	9	2	1	2	0	0
EDISC	86	4	2	6	1	1
KIP	74	39	32	49	3	13
MSP	2	4	2	5	2	4
PSRAP	67	1	0	2	0	0

PROCESSOR UTILIZATION FOR POPUP TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	59	15	1	42	16	270
1	60	11	0	49	15	243
2	43	16	0	56	17	306
3	37	14	0	81	19	372
4	37	14	0	57	17	311
5	32	14	0	73	18	332
6	44	12	0	47	15	251
TOTAL	312	14				

- RUN 8 -

PERCENT OF PROCESSING TIME DISTRIBUTED

START TIME = 1:03:02.865

END TIME = 1:03:07.543

PROCESSOR	PLANNED	POPU	DEAD	INACTIVE	IDLE	OVERHEAD
0	54.904	18.328	3.318	4.591	.000	18.851
1	56.033	13.693	3.443	5.468	.000	21.355
2	56.742	14.382	2.482	4.382	.000	22.003
3	59.185	11.105	3.402	4.779	.000	21.523
4	58.871	10.855	3.611	6.095	.000	20.562
5	61.042	9.142	4.091	3.923	.000	21.794
6	58.642	11.376	3.505	5.009	.000	21.460

Average Lattice Time = 55.7

- RUN 8 -

TASK TIMING STATISTICS
START TIME = 1:04:03.776
END TIME = 1:04:08.492

PLANNED TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	340	1	0	9	1	1
AOP	85	1	1	5	0	0
CMRC	85	1	1	4	0	0
CRIT1	86	2	1	74	7	62
DOP	85	11	4	21	3	15
IFT1	85	1	1	5	0	0
IFO	85	9	8	16	1	2
KOFA	85	5	3	10	1	2
MAT	85	1	0	3	0	0
MSAN	340	1	0	8	0	0
MT1	85	1	0	6	1	1
PAUS	258	6	1	15	3	9
PAUS1	172	7	3	13	1	2
PAUS2	172	7	1	13	2	4
PDOP	85	4	1	23	5	28
RDOP	85	10	3	22	6	39
RKTP	86	5	3	11	1	1
RTDOP	85	4	3	8	1	1
SCTME	258	1	1	14	1	2
SLJNK	85	6	5	13	2	4
SWABS	340	1	0	7	1	1
TCRSS	340	2	0	21	2	4
TDOP	255	10	5	23	3	9
TDOPI	170	10	5	18	3	10
TEDC	340	1	0	8	1	1
TEDEC	86	2	1	11	1	1
TINIT	172	1	1	5	0	0
TINT1	172	1	0	5	0	0
TPRED	340	2	0	16	1	2
TPSEC	340	2	0	28	2	8
TPUR	340	1	0	9	1	1
TROUT	172	2	1	5	1	1
TROU1	171	2	1	7	1	1
TUDS	86	2	1	19	3	10
TUD	86	1	1	14	1	2

- RIN 8 -

PROCESSOR UTILIZATION FOR PLANNED TASK

START TIME = 1:04:03.776

END TIME = 1:04:08.492

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	857	3	0	74	4	17
1	795	4	0	23	4	18
2	931	3	0	21	3	12
3	912	3	0	19	3	13
4	871	3	0	21	3	13
5	952	3	0	28	3	12
6	824	3	0	23	3	15
TOTAL	6142	3				

- RUN 8 -

TASK TIMING STATISTICS

START TIME = 1:04:03.776

END TIME = 1:04:08.492

POPUP TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ANCTK	73	13	1	83	16	263
CDT	2	2	2	2	0	0
CTIP	9	1	1	2	0	0
EDISC	85	4	2	7	1	2
KIP	73	40	32	51	4	19
MSP	2	3	1	5	2	8
PSRAP	68	1	0	5	0	0

PROCESSOR UTILIZATION FOR POPUP TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	69	14	0	60	16	271
1	49	13	0	49	17	299
2	39	16	0	83	20	432
3	40	13	0	48	16	262
4	44	15	0	49	17	309
5	37	10	0	48	14	206
6	34	17	0	51	18	360
TOTAL	312	14				

- RUN 8 -
 PERCENT OF PROCESSING TIME DISTRIBUTION
 START TIME = 1:04:03.776
 END TIME = 1:04:08.492

PROCESSOR	PLANNED	POPUP	DEAD	INACTIVE	IDLE	OVERHEAD
0	53.613	19.775	2.753	4.845	.000	19.009
1	58.851	13.251	2.773	4.740	.000	20.375
2	57.320	12.609	3.808	4.927	.000	21.328
3	59.431	10.808	3.187	4.658	.000	21.908
4	57.298	13.376	3.457	4.244	.000	21.619
5	60.052	7.806	3.748	4.451	.000	23.937
6	58.396	12.050	3.996	5.714	.000	19.837

Average Lattice Time = 56.3

- RUN 8 -

TASK TIMING STATISTICS

START TIME = 1:05:12.750

END TIME = 1:08:58.772

PLANNED TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	14864	1	0	14	1	1
A0A	3717	1	0	9	1	1
CORC	3717	1	1	8	0	0
CRITI	3717	2	0	91	8	77
DDP	3716	13	4	24	3	11
IFI	3716	1	0	10	1	1
IFO	3717	10	1	27	2	6
KOFA	3716	5	3	118	4	22
MAT	3717	2	0	39	2	5
MSAM	14864	1	0	16	1	1
MT1	3715	1	0	10	1	1
PAUS	11148	7	0	36	3	15
PAUS1	7432	8	1	35	2	6
PAUS2	7432	7	0	33	3	9
POOP	3716	4	0	30	5	34
RDOP	3716	11	3	31	6	38
RKIP	3717	5	3	15	1	2
RTDOP	3716	5	3	14	1	1
SCIME	11148	1	0	16	1	3
SLINK	3716	7	4	25	2	6
SWABS	14864	1	0	13	0	0
TCRSS	14863	2	0	70	4	18
TDOP	11148	10	5	25	3	10
TDOP1	7432	10	5	26	3	10
TEDC	14863	2	0	65	2	7
TEDEC	3716	2	1	13	1	1
TINTT	7434	2	0	50	3	10
TINT1	7434	2	0	44	2	4
TPRED	14864	2	0	70	3	13
TPSEC	14864	2	0	52	3	15
TPUR	14864	2	0	53	2	5
TROUT	7434	2	0	14	1	1
TROU1	7433	2	0	10	1	1
TUDS	3716	4	1	33	5	29
TUD	3716	3	1	33	4	18

- RUN 8 -
PROCESSOR UTILIZATION FOR PLANNED TASK
START TIME = 1:05:12.750
END TIME = 1:08:58.772

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	41100	3	0	78	4	16
1	34836	4	0	91	4	22
2	39147	3	0	87	4	19
3	38712	3	0	82	4	19
4	37203	4	0	85	4	20
5	37066	4	0	90	4	20
6	39498	3	0	118	4	18
TOTAL	267562	3				

- RUN 8 -

TASK TIMING STATISTICS
START TIME - 1:05:12.750
END TIME - 1:08:58.772

POPIR TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ANCTK	3224	29	0	342	40	1667
CDT	56	2	1	3	0	0
CTIP	452	2	1	5	0	0
EDISC	3478	3	1	13	1	1
IFT	12	1	1	4	1	1
KIP	3566	40	30	64	4	23
MSP	22	4	1	8	2	6
PSRAP	3259	1	0	8	0	0

PROCESSOR UTILIZATION FOR POPIR TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	2539	17	0	228	23	553
1	2075	20	0	342	29	854
2	2054	18	0	244	25	639
3	1902	18	0	284	26	680
4	1817	18	0	240	24	621
5	1773	18	0	324	27	730
6	1909	17	0	305	24	610
TOTAL	14069	18				

- RUN 8 -

PERCENT OF PROCESSING TIME DISTRIBUTION

START TIME = 1:05:12.750

END TIME = 1:08:58.772

PROCESSOR	PLANNED	POPU	DEAD	INACTIVE	IDLE	OVERHEAD
0	54.707	18.648	4.337	4.689	.000	17.613
1	55.613	18.230	3.986	4.728	.000	17.435
2	57.216	15.712	4.283	4.300	.000	18.482
3	58.111	14.509	4.257	4.337	.000	18.777
4	58.570	14.189	4.386	4.457	.000	18.392
5	58.791	13.916	4.138	4.021	.000	19.128
6	58.812	13.974	4.494	4.328	.000	18.384

Average Lattice Time = 987.9

- RUN 8 -

TASK TIMING STATISTICS
START TIME = 1:09:05.689
END TIME = 1:09:13.591

PLANNED TASK	# RUNS	AVERAGE TIME(MILLS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	524	1	0	11	1	1
AOM	131	1	0	5	0	0
CDRC	131	1	1	8	1	1
CRIT1	131	2	0	79	9	92
DOP	131	13	4	21	3	13
IFI	131	1	1	4	0	0
IFO	131	10	8	22	2	6
KOFA	131	5	3	11	1	3
MAT	131	1	0	4	0	0
MSAM	524	1	0	13	1	1
MT1	131	1	0	4	0	0
PAUS	393	7	1	21	3	15
PAUS1	262	8	1	18	2	6
PAUS2	262	7	1	22	3	10
PDOP	131	4	0	30	5	33
RDOP	131	11	3	22	6	36
RKIP	131	5	3	11	1	2
RTDOP	131	1	4	11	1	1
SCTME	393	1	1	15	1	3
SLINK	131	7	5	19	3	9
SWABS	524	1	0	8	0	0
TCRSS	524	2	0	49	3	13
TDOP	393	10	5	20	3	10
TDOP1	262	10	5	20	3	10
TEDC	524	2	0	42	3	13
TEDEC	130	2	1	9	1	1
TINIT	262	2	0	20	1	3
TINT1	262	2	0	13	1	2
TPRED	524	2	0	47	3	13
TPSEC	524	2	0	38	3	14
TPUR	524	2	0	17	1	2
TROUT	262	2	1	7	1	1
TROUT1	262	2	1	10	1	1
TUDS	130	4	1	29	6	36
TUD	130	1	1	14	1	2

- RUN 8 -
PROCESSOR UTILIZATION FOR PLANNED TASK
START TIME = 1:09:05.689
END TIME = 1:09:13.591

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	1395	3	0	49	4	17
1	1239	4	0	79	5	25
2	1365	3	0	23	3	14
3	1386	3	0	28	4	16
4	1335	4	0	79	4	22
5	1307	4	0	42	4	19
6	1402	3	0	29	4	16
TOTAL	9429	3				

- RUN 8 -

TASK TIMING STATISTICS
START TIME = 1:09:05.689
END TIME = 1:09:13.591

POPIUP TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ANCTK	108	35	1	299	49	2408
CNT	2	2	1	2	0	0
CTIP	16	2	1	3	0	0
EDISC	123	3	1	5	1	1
KIP	124	40	33	54	4	24
MSP	2	3	1	5	2	8
PSRAP	114	1	0	6	0	0

PROCESSOR UTILIZATION FOR POPIUP TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	91	20	0	205	26	709
1	68	20	0	155	27	783
2	76	21	0	186	34	1177
3	68	19	0	299	40	1621
4	60	16	0	70	20	432
5	56	22	0	120	27	734
6	70	15	0	120	22	520
TOTAL	489	19				

- RUN 8 -
 PERCENT OF PROCESSING TIME DISTRIBUTION
 START TIME = 1:09:05.689
 END TIME = 1:09:13.591

PROCESSOR	PLANNED	POPIR	DEAD	INACTIVE	IDLE	OVERHEAD
0	52.267	22.492	4.212	4.843	.000	16.177
1	57.482	16.660	2.693	5.363	.000	17.796
2	54.072	19.761	3.435	4.349	.000	18.376
3	57.878	15.781	4.064	4.238	.000	18.031
4	60.992	12.185	3.373	3.941	.000	19.501
5	58.447	15.412	2.816	4.115	.000	19.205
6	59.769	13.347	2.890	5.078	.000	18.908

Average Lattice Time = 61.3

- RUN 8 -
 TASK TIMING STATISTICS
 START TIME = 1:12:00.861
 END TIME = 1:12:04.447

PLANNED TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	244	1	0	8	1	1
AOP	62	1	1	4	0	0
CDRC	62	1	1	4	0	0
CRITI	62	2	1	75	9	88
DUP	61	13	4	21	3	11
IFT	61	1	0	6	1	1
IFO	62	10	8	21	2	8
KOFA	61	5	3	9	1	2
MAT	62	1	0	2	0	0
MSAW	245	1	0	10	1	1
MT1	62	2	1	5	1	1
PAUS	186	7	0	18	4	16
PAUS1	124	8	5	17	2	5
PAUS2	124	7	1	18	3	10
PDOP	62	4	1	23	6	37
RDOP	61	10	3	22	5	34
RKTP	62	5	3	8	1	2
RTDOP	61	4	4	7	1	1
SCIME	186	1	1	6	0	0
SLINK	61	7	5	14	2	5
SNABS	245	1	0	6	0	0
TCRSS	244	2	0	29	3	11
TDOP	183	10	5	22	3	11
TDOP1	122	10	5	19	3	11
TEDC	245	2	0	25	3	9
TEXEC	62	2	1	3	0	0
TINIT	124	2	1	10	1	2
TINT1	124	1	1	8	1	1
TPRED	245	2	0	52	3	15
TPSEC	245	2	1	40	4	16
TPUR	245	1	0	14	1	2
TROUT	124	2	0	6	1	1
TROU1	124	2	1	5	1	1
TUDS	62	2	1	13	2	5
TUD	62	1	1	2	0	0

- RUN 8 -
 PROCESSOR UTILIZATION FOR PLANNED TASK
 START TIME = 1:12:00.861
 END TIME = 1:12:04.447

PROCESSOR	# RUNS	AVERAGE TIME PER TASK (HRS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	698	3	0	25	3	14
1	620	4	0	40	4	20
2	617	3	0	20	3	13
3	610	4	0	75	5	29
4	601	4	0	23	4	17
5	634	3	0	22	4	16
6	647	3	0	29	4	16
TOTAL	4427	3				

- RUN 8 -

TASK TIMING STATISTICS
START TIME = 1:12:00.861
END TIME = 1:12:04.447

POPIUP TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	50	33	1	230	43	1909
CDT	1	1	1	1	1	1
CTIP	7	2	1	3	1	1
EDISC	65	4	1	8	1	2
KIP	56	40	32	50	4	23
MSP	2	3	1	5	2	8
PSRAP	52	1	0	3	0	0

PROCESSOR UTILIZATION FOR POPIUP TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	49	14	0	99	19	397
1	39	13	0	51	17	308
2	34	25	0	117	27	776
3	25	25	0	230	46	2148
4	31	17	0	53	19	386
5	26	20	0	145	35	1249
6	29	18	0	45	17	301
TOTAL	233	18				

- RUN 8 -
 PERCENT OF PROCESSING TIME DISTRIBUTION
 START TIME = 1:12:00.861
 END TIME = 1:12:04.447

PROCESSOR	PLANNED	POPU	DEAD	INACTIVE	IDLE	OVERHEAD
0	56.480	18.109	1.878	4.601	.000	18.925
1	60.755	13.398	2.640	5.228	.000	17.972
2	52.068	23.365	2.531	3.974	.000	18.054
3	59.503	17.292	1.468	3.429	.000	18.298
4	58.986	14.486	2.832	4.410	.000	19.279
5	58.740	14.105	2.859	3.974	.000	20.314
6	60.320	14.160	2.177	4.382	.000	18.953

Average Lattice Time = 59.3

TASK TIMING STATISTICS

PLANNED TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	2825	2	0	12	1	2
AOB	707	1	0	9	0	0
CDRC	707	1	1	6	0	0
CRITI	707	3	0	77	9	97
DOP	707	4	2	14	1	3
IFI	706	1	0	7	0	0
IFO	707	8	1	16	2	4
KOFA	706	8	2	77	13	187
MAT	706	3	0	32	6	38
MSAM	2824	2	0	11	1	1
MT1	706	1	0	8	0	0
PAUS	2118	19	1	167	13	171
PAUS1	1412	22	1	173	12	145
PAUS2	1412	20	1	129	11	128
PDOF	707	4	0	18	4	16
ROOP	706	12	3	21	3	12
RKIP	707	4	3	14	1	1
RTDOP	706	4	2	8	1	1
SCTHE	2118	1	0	16	1	3
SLINK	706	8	3	60	4	23
SWABS	2824	1	0	10	0	0
TGRSS	2825	6	0	49	7	52
TDOP	2118	7	4	47	1	3
TDOP1	1412	7	4	47	1	3
TEDC	2825	10	0	65	13	191
TEDEC	707	2	1	12	1	1
TINIT	1413	4	0	37	5	27
TINTI	1414	3	0	33	3	14
TPRED	2824	8	0	49	8	65
TPSEC	2824	6	0	27	5	32
TPUR	2824	2	0	50	4	21
TROUT	1414	3	0	13	1	2
TROU1	1414	2	0	9	1	2
TUDS	707	7	0	24	6	37
TUD	707	4	1	20	5	27

- RUN 9 -

PROCESSOR UTILIZATION FOR PLANNED TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	7186	6	0	167	8	76
1	7485	6	0	116	8	68
2	7451	6	0	144	8	72
3	7249	6	0	173	8	73
4	7197	6	0	129	8	68
5	7379	6	0	110	8	70
6	6905	6	0	158	8	76
TOTAL	50852	6				

- RUN 9 -

TASK TIMING STATISTICS

POUP TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
CDT	35	6	2	10	1	2
CTIP	120	2	1	4	0	0
EDTSC	2590	4	1	87	5	33
KIP	923	13	8	26	2	7
PSRAP	852	8	1	25	4	19

PROCESSOR UTILIZATION FOR POPUP TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	711	6	1	87	6	40
1	718	7	1	84	7	61
2	644	7	1	25	4	23
3	635	7	1	86	7	50
4	619	7	1	23	4	21
5	564	6	1	84	6	39
6	629	7	1	86	5	32
TOTAL	4520	7				

- RUN 9 -

PERCENT OF PROCESSING TIME DISTRIBUTION

PROCESSOR	PLANNED	POPUP	DEAD	INACTIVE	IDLE	OVERHEAD
0	70.160	7.375	5.589	4.447	.000	12.419
1	68.931	8.035	5.777	5.421	.000	11.828
2	69.906	6.955	6.332	4.990	.000	11.812
3	69.564	7.011	6.289	4.839	.000	12.291
4	69.960	6.548	6.658	4.888	.000	11.939
5	70.427	5.921	6.458	4.998	.000	12.189
6	70.146	6.923	6.322	4.796	.000	11.804

Average Lattice Time = 87.3

- RUN 10 -

TASK TIMING STATISTICS

PLANNED TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	2928	2	0	12	1	3
AOM	733	1	0	8	0	0
CDBC	733	1	1	10	1	1
CRITI	733	3	0	89	10	108
DOP	733	4	2	20	1	3
IFT	732	1	0	11	0	0
IFO	733	8	1	17	2	4
KOFA	732	7	3	84	12	151
MAT	732	3	0	34	6	43
MSAM	2928	2	1	11	1	1
MT1	732	1	0	4	0	0
PAUS	2196	17	0	70	10	108
PAUS1	1464	20	1	64	9	86
PAUS2	1464	18	1	65	8	80
PDOF	733	3	0	16	3	12
RDOF	732	12	3	19	3	13
RKIP	733	4	3	14	1	1
RTDOP	732	5	2	9	1	1
SCTME	2196	1	0	16	2	4
SLINK	733	9	3	52	5	26
SWABS	2928	1	0	8	0	0
TCRSS	2928	6	0	47	7	49
TDOP	2196	8	4	40	2	4
TDOP1	1464	8	4	40	2	4
REDC	2928	10	0	65	13	187
TEXEC	733	2	1	13	1	1
TINIT	1464	4	0	32	4	22
TINT1	1464	3	0	26	3	11
TPRED	2928	8	0	48	8	69
TPSEC	2928	6	0	30	5	31
TPUR	2928	2	0	69	4	22
TROUT	1464	3	0	10	1	3
TROU1	1464	2	0	9	1	2
TUDS	732	7	1	23	6	36
TUD	733	3	1	19	4	24

- RUN 10 -

PROCESSOR UTILIZATION FOR PLANNED TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	7566	6	0	84	7	62
1	7747	6	0	79	7	60
2	7760	6	0	78	7	58
3	7544	6	0	81	7	57
4	7482	6	0	78	7	61
5	7429	6	0	78	7	62
6	7186	6	0	89	7	63
TOTAL	52714	6				

- RUN 10 -

TASK TIMING STATISTICS

POPUP TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
CDT	37	6	5	9	1	1
CTIP	120	1	1	4	0	0
EDISC	2598	4	1	93	5	34
KIP	934	11	6	22	2	5
PSRAP	861	7	1	25	3	15

PROCESSOR UTILIZATION FOR POPUP TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	719	6	1	82	4	24
1	748	6	1	18	3	13
2	666	6	1	82	4	22
3	612	6	1	86	5	34
4	592	6	1	85	4	24
5	584	6	1	86	5	34
6	629	7	1	93	8	76
TOTAL	4550	6				

- RUN 10 -

PERCENT OF PROCESSING TIME DISTRIBUTION

PROCESSOR	PLANNED	POPOP	DEAD	INACTIVE	IDLE	OVERHEAD
0	70.460	6.775	5.490	4.492	.000	12.777
1	69.750	7.160	5.873	4.896	.000	12.316
2	69.550	6.564	6.630	5.093	.000	12.154
3	69.710	6.357	6.308	5.130	.000	12.486
4	70.332	5.628	6.546	5.162	.000	12.324
5	70.494	5.904	6.423	4.814	.000	12.357
6	69.494	6.941	6.509	4.994	.000	12.054

Average Lattice Time = 84.3

- RUN 11 -

TASK TIMING STATISTICS

PLANNED TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	3128	2	0	11	1	2
AO9	782	1	1	8	0	0
CDRC	783	3	0	83	10	0
CRITI	783	4	1	15	2	103
DOP	782	9	1	15	0	4
IFI	782	1	0	7	0	0
IFO	782	4	1	15	2	4
KOFA	782	1	3	8	0	0
MAT	782	1	0	36	2	8
MSAW	3128	2	1	14	1	1
MT1	782	1	0	5	0	0
PAUS	2346	17	0	181	12	149
PAUS1	1564	20	5	240	12	150
PAUS2	1564	18	1	231	12	151
POOP	782	4	0	17	4	17
RDOP	782	11	3	19	3	15
RKTP	783	4	3	13	1	1
RTDOP	782	5	3	9	1	1
SCTME	2346	1	0	18	2	4
SLINK	782	8	4	28	3	13
SWABS	3128	1	0	12	0	0
TCRSS	3128	6	0	41	6	48
TDOP	2346	8	5	23	1	2
TDOP1	1564	8	5	14	1	2
TEDC	3128	9	0	64	13	181
TEDEC	783	2	1	13	1	1
TINIT	1565	4	0	59	4	23
TINT1	1566	2	0	51	3	11
TPRED	3128	7	0	52	8	67
TPSEC	3128	5	0	32	5	31
TPUR	3128	2	0	67	4	22
TROUT	1565	3	0	13	1	3
TROU1	1565	2	0	8	1	2
TUDS	783	6	1	21	5	34
TUD	783	3	1	19	3	15

- RUN 11 -

PROCESSOR UTILIZATION FOR PLANNED TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	8054	6	0	240	8	67
1	8346	5	0	231	7	63
2	8248	5	0	142	7	59
3	8003	6	0	118	7	60
4	7908	6	0	212	7	63
5	8000	6	0	181	7	63
6	7757	6	0	172	8	67
TOTAL	56316	6				

- RUN 11 -

TASK TIMING STATISTICS

POPUP TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
CDT	16	2	2	2	0	0
CTIP	122	2	1	4	0	0
EDISC	2620	4	1	87	5	33
KIP	936	13	8	29	3	9
MSP	417	3	0	7	1	3
PSRAP	871	7	1	22	3	15

PROCESSOR UTILIZATION FOR POPUP TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	813	6	0	85	5	26
1	762	6	0	84	7	50
2	725	6	0	85	6	36
3	686	6	1	87	6	38
4	682	6	1	81	5	25
5	673	6	0	82	5	33
6	641	6	0	86	5	29
TOTAL	4982	6				

- RUN 11 -

PERCENT OF PROCESSING TIME DISTRIBUTION

PROCESSOR	PLANNED	POPUP	DEAD	INACTIVE	IDLE	OVERHEAD
0	71.083	7.443	2.964	4.814	.000	13.687
1	70.957	7.587	3.191	5.000	.000	13.261
2	71.093	7.351	3.066	5.097	.000	13.384
3	71.273	6.986	3.072	4.988	.000	13.673
4	71.523	6.775	3.318	5.078	.000	13.300
5	71.593	6.410	3.244	5.050	.000	13.695
6	71.421	6.417	3.533	4.972	.000	13.650

Average Lattice Time = 80.3

- RUN 12 -

TASK TIMING STATISTICS

PLANNED TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	540	2	0	9	1	2
AOB	135	1	0	4	0	0
CDRC	135	1	1	5	0	0
CRITI	135	2	1	75	8	79
DOP	135	3	1	21	2	4
IFT	135	1	0	6	0	0
IFO	135	9	2	13	1	1
KOFA	135	4	3	8	1	1
MAT	135	1	0	18	1	2
MSAW	540	2	0	8	1	1
MT1	135	1	0	6	0	0
PAUS	405	11	0	39	6	42
PAUS1	270	13	6	38	5	27
PAUS2	270	12	1	34	5	26
PDOP	135	2	0	11	2	4
RDOP	135	10	3	16	4	21
RKIP	135	4	3	5	0	0
RTDOP	135	4	3	7	1	1
SCTME	405	1	0	14	2	4
SLINK	135	8	3	25	4	16
SWABS	540	1	0	7	0	0
TCRSS	540	5	0	37	6	42
TDOP	405	7	4	17	1	2
TDOP1	270	7	5	11	1	2
TEDC	540	8	0	60	12	156
TEXEC	136	2	1	12	1	2
TINIT	270	3	1	18	3	12
TINT1	270	2	1	20	3	9
TPRED	540	7	0	44	8	65
TPSEC	540	5	0	27	5	29
TPUR	540	2	0	47	4	21
TROUT	270	3	1	14	2	4
TRQU1	270	2	0	6	1	2
TUDS	135	5	1	17	5	31
TUD	136	2	1	14	3	12

- RUN 12 -

PROCESSOR UTILIZATION FOR PLANNED TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILLS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	1358	5	0	60	6	41
1	1437	4	0	60	6	36
2	1385	5	0	54	6	38
3	1355	5	0	60	6	38
4	1383	5	0	60	5	34
5	1468	4	0	75	5	32
6	1336	5	0	44	5	32
TOTAL	9722	5				

- RUN 12 -

TASK TIMING STATISTICS

POPUP TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
CDT	2	2	1	2	0	0
CTIP	18	2	1	3	0	0
EDISC	418	4	1	87	5	34
KIP	145	10	7	18	2	4
MSP	28	3	0	6	1	3
PSRAP	132	7	1	15	3	13

PROCESSOR UTILIZATION FOR POPUP TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	127	5	0	86	7	63
1	108	6	0	16	3	12
2	115	6	0	87	8	67
3	116	6	0	16	3	12
4	86	6	1	17	3	12
5	103	6	0	18	3	14
6	88	6	0	13	3	11
TOTAL	743	6				

- RUN 12 -

PERCENT OF PROCESSING TIME DISTRIBUTION

PROCESSOR	PLANNED	POPUP	DEAD	INACTIVE	IDLE	OVERHEAD
0	67.947	7.218	2.929	5.933	.000	15.966
1	67.822	6.470	3.625	6.238	.000	15.839
2	66.789	6.933	3.666	6.185	.000	16.419
3	67.199	7.103	3.572	5.921	.000	16.199
4	67.990	5.480	3.751	6.554	.000	16.218
5	67.599	6.585	2.697	6.111	.000	17.000
6	67.474	5.375	4.152	6.775	.000	16.218

Average Lattice Time = 70

- RUN 13 -

TASK TIMING STATISTICS

PLANNED TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	2108	2	0	9	1	2
ADW	528	1	0	6	0	0
CDRC	528	1	1	4	0	0
CRITI	528	3	0	81	11	128
DOP	528	4	2	15	1	3
IFI	527	1	0	4	0	0
IFO	528	8	1	14	2	5
KOFA	527	7	1	39	10	102
MAT	527	2	0	35	3	14
MSAM	2108	2	0	10	1	1
MTI	527	1	0	4	0	0
PAUS	1581	21	0	103	18	347
PAUS1	1054	27	0	80	15	255
PAUS2	1054	17	0	91	18	346
PDOOP	528	4	0	16	4	19
RDOP	527	13	3	16	1	3
RKIP	528	4	3	9	0	0
RTDOP	527	4	3	8	1	1
SCTME	1581	1	0	14	2	4
SLINK	528	9	4	44	5	29
SWABS	2108	1	0	6	0	0
TCRSS	2108	8	0	35	7	55
TDOP	1581	7	4	22	1	2
TDOP1	1054	7	5	17	1	3
TEDC	2108	13	0	64	14	202
TEXEC	528	2	1	9	1	1
TINIT	1055	4	0	46	5	26
TINT1	1054	3	0	51	4	19
TPRED	2108	10	0	51	7	60
TPSEC	2108	7	0	30	5	31
TPUR	2108	3	0	39	4	23
TROUT	1054	3	0	7	1	1
TROU1	1054	3	0	8	1	2
TUDS	528	8	0	17	6	36
TUD	528	3	0	18	4	23

- RUN 13 -

PROCESSOR UTILIZATION FOR PLANNED TASK

PROCESSOR	# RUNS	AVERAGE TIME		MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
		PER TASK	(MILS)				
0	7464	7		0	85	9	97
1	7861	6		0	91	9	94
2	7510	7		0	103	9	95
3	7552	7		0	80	9	98
4	7569	7		0	83	9	94
TOTAL	37956	7					

- RUN 13 -

TASK TIMING STATISTICS

POPUP TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
CDT	37	6	2	11	1	2
CTIP	121	1	1	4	0	0
EDISC	2443	4	1	86	5	32
KIP	916	12	8	23	1	3
PSRAP	839	8	1	30	5	25

PROCESSOR UTILIZATION FOR POPUP TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	912	6	1	83	5	32
1	882	6	1	28	4	18
2	885	6	1	84	6	39
3	829	6	1	86	6	39
4	848	7	1	86	6	48
TOTAL	4356	6				

- RUN 13 -

PERCENT OF PROCESSING TIME DISTRIBUTION

PROCESSOR	PLANNED	POPUP	DEAD	INACTIVE	IDLE	OVERHEAD
0	79.720	8.708	1.078	1.669	.000	8.816
1	79.568	8.636	1.267	1.660	.000	8.861
2	79.582	9.173	1.041	1.601	.000	8.597
3	80.023	8.535	.912	1.542	.000	8.984
4	79.589	9.125	1.031	1.490	.000	8.759

Average Lattice Time = 118

- RUN 14 -

TASK TIMING STATISTICS

PLANNED TASK	# RUNS	AVERAGE TIME (MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
ALTRK	2732	2	0	9	1	2
AOR	684	1	0	5	0	0
CDRC	684	1	0	4	0	0
CRITI	683	2	0	77	10	102
DOP	683	2	1	11	0	0
IFI	683	1	0	4	0	0
IFO	683	8	1	13	2	4
KOFA	683	4	3	8	0	0
MAT	684	1	0	31	2	5
MSAW	2732	1	0	9	1	1
MT1	683	1	0	4	0	0
PAUS	2049	12	0	101	11	122
PAUS1	1366	14	0	123	10	102
PAUS2	1366	10	0	95	10	117
PDOF	684	3	0	9	2	6
ROOP	684	12	3	18	2	7
RKIP	683	3	3	7	0	0
RTDOP	683	4	3	7	1	1
SCTHE	2049	1	0	17	1	3
SLINK	684	8	3	35	4	18
SWABS	2732	1	0	6	0	0
TCRSS	2732	6	0	37	6	45
TDOP	2049	7	4	15	1	2
TDOP1	1366	7	4	13	1	2
TEDC	2732	10	0	64	13	185
TEDEC	683	2	1	9	1	1
TINIT	1366	3	0	23	3	14
TINT1	1367	2	0	32	3	11
TPRED	2732	7	0	40	7	57
TPSEC	2732	6	0	25	5	28
TPUR	2732	2	0	36	4	18
TROUT	1367	3	0	8	1	2
TROU1	1367	2	0	7	1	2
TUDS	683	6	0	18	5	35
TUD	683	2	0	18	3	12

- RUN 14 -

PROCESSOR UTILIZATION FOR PLANNED TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	9544	5	0	123	7	50
1	9880	5	0	74	6	46
2	10139	5	0	96	6	44
3	9828	5	0	95	6	47
4	9794	5	0	97	6	48
TOTAL	49185	5				

- RUN 14 -

TASK TIMING STATISTICS

POPUP TASK	# RUNS	AVERAGE TIME(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
CDT	47	5	2	8	1	2
CTIP	121	1	1	3	0	0
EDISC	2554	4	1	86	5	33
KIP	934	10	7	15	1	2
PSRAP	862	6	1	20	3	12

PROCESSOR UTILIZATION FOR POPUP TASK

PROCESSOR	# RUNS	AVERAGE TIME PER TASK(MILS)	MINIMUM	MAXIMUM	STANDARD DEVIATION	VARIANCE
0	988	6	1	85	5	35
1	941	6	1	82	4	17
2	867	5	1	84	6	38
3	878	5	1	86	4	23
4	844	5	1	84	4	24
TOTAL	4518	6				

- RUN 14 -

PERCENT OF PROCESSING TIME DISTRIBUTION

PROCESSOR	PLANNED	POPUP	DEAD	INACTIVE	IDLE	OVERHEAD
0	76.355	9.027	1.013	1.777	.000	11.820
1	76.867	8.529	1.048	1.931	.000	11.617
2	77.001	7.679	1.146	2.197	.000	11.968
3	77.162	7.732	.890	2.046	.000	12.162
4	77.634	7.455	1.058	1.902	.000	11.945

Average Lattice Time = 90.3

APPENDIX L

PROCESSOR UTILIZATION MODELS FOR THE YEARS 1982 THROUGH 1990

PROCESSOR UTILIZATION MODELS (1982)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
ALIRK	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 2.6 \quad \sigma = 0.4$	$\bar{t} = 1.3 \quad \sigma = .325$
AUG	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.5$	
COR	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
CRIT	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
DOP	1/Lattice	1/Lattice	$t = 1.4(\#MDBMs)$	
IFI	1/Lattice	1/Lattice	$\bar{t} = 5.0 \quad \sigma = 0.0$	
IFO	1/Lattice	1/Lattice	$\bar{t} = 8.3 \quad \sigma = 1.6$	
KOFA	1/Lattice	1/Lattice	$\bar{t} = 5.4 \quad \sigma = 4.3$	
MAT	1/60 Seconds	1/Lattice	$t_s = 0.001(CTS \text{ Capacity})$ $(t_{MAX} = 32)$	$\bar{t} = 1.25 \quad \sigma = 0.452$
MSAW	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 1.8 \quad \sigma = 1.0$	$\bar{t} = 1.8 \quad \sigma = 1.0$
MTP	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
PAUS	P/Lattice (P=#Processors)	P/Lattice	$\Sigma t(p) = 0.0381 (CTS) + 0.425(t_L)(T1)$ $p=1 \quad \#Snsr \quad \sum_{j=1}^{32} \left[\frac{t_s(j)}{t_s(j)} \right] \left[\#Displays(j) \right]$	
<p>TU = Unassociated Tracks J = Snsr ID k = Sector ID t_L = Execution Time of Previous Lattice t_s = Sensor Scan Time</p>				

PROCESSOR UTILIZATION MODELS (198?) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
PDOP	4/Second	1/Lattice	$t = 0.6(\#RDBMs)$	$\bar{t} = 1.7 \quad \sigma = 1.3$
RIDOP	1/Lattice at Sites with RDBMs	1/Lattice at Sites with RDBMs	$t = 2.4(\#RDBMs)$	
RKIP	1/Lattice at Sites with RDBMs	1/Lattice at Sites with RDBMs	$t = 1.3(\#RDBMs)$	
RTDOP	1/Lattice at Sites with RDBMs	1/Lattice at Sites with RDBMs	$t = 0.6(\#RDBMs)$	
SCTIME	Detroit: 1/Lat NY CHI LA } 3/Lat	Detroit: 1/Lat NY CHI LA } 3/Lat	$\sum_{i=1}^I t(i) = 0.0011(\text{CTS Capacity})$ $I = \# \text{Executions/Lattice}$	
SLINK	1/Lattice at Multisnr Site	1/Lattice at Multisnr Site	$\bar{t} = 8.2 \quad \sigma = 2.7 \quad (t_{MAX} = 80)$	$\bar{t} = 1.0$
SWABS	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 1.0 \quad \sigma = 0.0 \quad (t_{MAX} = 64)$	$\bar{t} = 3.1 \quad \sigma = 1.3$
TCRSS	1/Sector/Snsr	1/Lattice/Snsr	$t = 3.7 + TU \quad (t_{MAX} = 90)$ $TU = \# \text{Unassociated Tracks in Sector Processed}$	
TDOP	NY: 5/Lattice CHI: 3/Lattice LA: 2/Lattice DET: 1/Lattice	NY: 5/Lattice CHI: 3/Lattice LA: 2/Lattice DET: 1/Lattice	$\sum_{i=1}^I t(i) = 2.9(\#RDBMs)$ $I = \# \text{Executions/Lattice}$	
TEDC	1/Sector/Snsr	1/Lattice/Snsr	$t = 1.7 + 0.55(ATD+UTD) + 0.2(TA)(TU)$ $(t_{MAX} = 60)$ $ATD = \# \text{Discrete Associated Tracks}$ $UTD = \# \text{Discrete Unassociated Tracks}$	$\bar{t} = 3.5 \quad \sigma = 2.5$

PROCESSOR UTILIZATION MODELS (1982) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
IEVEC	1/Lattice	1/Lattice	$t = 0.5(\#SRSRs)$	$\bar{t} = 3.2 \quad \sigma = 1.9$
TINIT	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 4.0 \quad \sigma = 4.1 \quad (\tau_{MAX} = 200)$	
TPRED	1/Sector/Snsr	1/Lattice/Snsr	$t = 3.1 + 1.3(TA+TU)$ $TA = \#Associated Tracks in Sector Processed$	$\bar{t} = 3.3 \quad \sigma = 1.8$
TPSEC	1/Sector/Snsr	1/Lattice/Snsr	$t = 7.8 + 0.5(TU)$	$\bar{t} = 3.4 \quad \sigma = 1.8$
TPUR	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 11.9 \quad \sigma = 10.9 \quad (\tau_{MAX} = 90)$	$\bar{t} = 3.2 \quad \sigma = 1.9$
TROUT	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 3.3 \quad \sigma = 1.7$	$\bar{t} = 2.9 \quad \sigma = 1.9$
TUOS	1/Lattice	1/Lattice	$t = 0.0066(CTS Capacity)$	
TUO	1/Lattice	1/Lattice	$t = 0.0038(CTS Capacity)$	
CDT	Prd = 1.3 Sec $\sigma = 0.79 Sec$	Random Popup	$\bar{t} = 3.6 \quad \sigma = 1.7$	
CTIP	Prd = 0.049 Sec	Periodic Popup	$\bar{t} = 1.8 \quad \sigma = 0.6$	
EDISC	Prd = 48.1 Mils $\sigma = 35.8 Mils$	Random Popup	$t = 0.0025(CTS Capacity)$	
IFT	Prd = 19.2 Sec $\sigma = 4.7 Sec$	Random Popup	$\bar{t} = 1.0 \quad \sigma = 0.0$	
KIP	Prd = 64.9 Mils	Periodic Popup	$t = 0.98(\#DBMs)$	
PSRAP	Prd = 70.7 Mils	Periodic Popup	$\bar{t} = 19.5 \quad \sigma = 8.0$	
MSP	Prd = 48.6 Mils $\sigma = 26.4 Mils$	Random Popup	$\bar{t} = 4.0 \quad \sigma = 2.6$	

PROCESSOR UTILIZATION MODELS (1982) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
Overhead for Task Initiation	Before Each Task		$\bar{t} = 0.33 \quad \sigma = 0.5$	
Lattice			$t_{\text{TIMEOUT}} = \begin{cases} 130 & \text{if Prcsng on Schedule} \\ 110 & \text{if 1 Sector Late} \\ 85 & \text{if 2 Sectors Late} \\ 60 & \text{if 3 Sectors Late} \\ 35 & \text{if 4 Sectors Late} \end{cases}$ <p>Lattice Execution Time is Compared to Timeout Value During PAUS Processing If Elapsed Lattice Execution Time Exceeds Timeout, PAUS is terminated,</p>	
CA	1/Sector/Snsr	1/Lattice/Snsr	$t(j) = 0.0015 \left[\sum_{k=1}^{32} \text{CTA}(j,k) \right]^2 + 0.084 \sum_{k=1}^{32} \text{CTA}(j,k)$ <p>$\text{CTA}(j,k) = \text{Mode C Beacon Only Associated Tracks} + \text{Mode C Radar Reinforced Beacon Associated Tracks} + \text{Linked Unassociated Tracks on Sensor } j \text{ in Sector } k.$</p>	$\bar{t} = 3$
CATRK	1/Sector/Snsr	1/Lattice/Snsr	$t(j) = 2[\text{CTA}(j,k)]$	$\bar{t} = 3$
CAIU	1/Lattice	1/Lattice	$\bar{t} = 2$	
TUOX	1/Lattice	1/Lattice	$t = 0.0066(\text{CTS})$	

PROCESSOR UTILIZATION MODELS (1984)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
AL FCK	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 2.6 \quad \sigma = 0.4$	$\bar{t} = 1.3 \quad \sigma = .325$
AUT	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.5$	
CDR	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
CRIT	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
DOP	1/Lattice	1/Lattice	$t = 1.4(\#DBMS)$	
IFI	1/Lattice	1/Lattice	$t = 10.0 \quad \sigma = 3.0$	
IFO	1/Lattice	1/Lattice	$\bar{t} = 10.0 \quad \sigma = 3.0$	
KOFA	1/Lattice	1/Lattice	$\bar{t} = 5.4 \quad \sigma = 4.3$	
MAT	1/60 Seconds	1/Lattice	$t = 0.001(\text{CTS Capacity})$ ($t_{MAX} = 32$)	$\bar{t} = 1.25 \quad \sigma = 0.425$
MSAW	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 1.8 \quad \sigma = 1.0$	$\bar{t} = 1.8 \quad \sigma = 1.0$
MTP	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
PAUS	P/Lattice ($P = \#Processors$)	P/Lattice	$t(p) = 0.0381(\text{CTS}) + 0.625(t_L)(T1)$ $p = \sum_{j=1}^{\#Snsr} \sum_{k=1}^{32} \left[\frac{t_s(j)}{t_s(j)} \right] \left[\#Displays(j) \right]$ <p> $T1$ = Unassociated Tracks j = Snsr ID k = Sector ID t_L = Execution Time of Previous Lattice t_s = Sensor Scan Time </p>	

PROCESSOR UTILIZATION MODELS (1984) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
PDOP	4/Second	1/Lattice	$t = 0.6(\#RDBMs)$	$\bar{t} = 1.7 \quad \sigma = 1.3$
RDOP	1/Lattice at Sites with RDBMs	1/Lattice at Sites with RDBMs	$t = 2.4(\#RDBMs)$	
RKIP	1/Lattice at Sites with RDBMs	1/Lattice at Sites with RDBMs	$t = 1.3(\#RDBMs)$	
RTDOP	1/Lattice at Sites with RDBMs	1/Lattice at Sites with RDBMs	$t = 0.6(\#RDBMs)$	
SCIME	Detroit: 1/Lat NY CHI } 3/Lat LA }	Detroit: 1/Lat NY CHI } 3/Lat LA }	$\sum_{i=1}^I t(i) = 0.0011(\text{CTS Capacity})$ $J = \# \text{Executions/Lattice}$	
SLINK	1/Lattice at Multisnr Site	1/Lattice at Multisnr Site	$\bar{t} = 8.2 \quad \sigma = 2.7 \quad (t_{MAX} = 80)$	$\bar{t} = 1.0$
SNABS	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 1.0 \quad \sigma = 0.0 \quad (t_{MAX} = 64)$	$\bar{t} = 3.1 \quad \sigma = 1.3$
TCRSS	1/Sector/Snsr	1/Lattice/Snsr	$t = 3.7 + TU \quad (t_{MAX} = 90)$ $TU = \# \text{Unassociated Tracks in Sector Processed}$	
TDOP	NY: 5/Lattice CHI: 3/Lattice LA: 2/Lattice DET: 1/Lattice	NY: 5/Lattice CHI: 3/Lattice LA: 2/Lattice DET: 1/Lattice	$\sum_{i=1}^I t(i) = 0.6(\#RDBMs)$ $I = \# \text{Executions/Lattice}$	
TEDC	1/Sector/Snsr	1/Lattice/Snsr	$t = 1.7 + 0.55(ATD+UTD) + 0.2(TA)(TU)$ $(t_{MAX} = 60)$ $ATD = \# \text{Discrete Associated Tracks}$ $UTD = \# \text{Discrete Unassociated Tracks}$	$\bar{t} = 3.5 \quad \sigma = 2.5$

PROCESSOR UTILIZATION MODELS (1984) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
TEEC	1/Lattice	1/Lattice	$t = 0.5(\#Snsrs)$	
TINIT	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 4.0 \quad \sigma = 4.1 \quad (t_{MAX} = 200)$	$\bar{t} = 3.2 \quad \sigma = 1.9$
TPRED	1/Sector/Snsr	1/Lattice/Snsr	$t = 3.1 + 1.3(TA+TU)$ $TA = \#Associated Tracks in Sector Processed$	$\bar{t} = 3.3 \quad \sigma = 1.8$
TPSEC	1/Sector/Snsr	1/Lattice/Snsr	$t = 7.8 + 0.5(TU)$	$\bar{t} = 3.4 \quad \sigma = 1.8$
TPUR	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 11.9 \quad \sigma = 10.9 \quad (t_{MAX} = 90)$	$\bar{t} = 3.2 \quad \sigma = 1.9$
TROUT	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 3.3 \quad \sigma = 1.7$	$\bar{t} = 2.9 \quad \sigma = 1.9$
TUDs	1/Lattice	1/Lattice	$t = 0.0066(CTS Capacity)$	
TUO	1/Lattice	1/Lattice	$t = 0.0038(CTS Capacity)$	
COT	$Prd = 1.3 \text{ Sec}$ $\sigma = 0.79 \text{ Sec}$	Random Popul	$\bar{t} = 3.6 \quad \sigma = 1.7$	
CTIP	$Prd = 0.049 \text{ Sec}$	Periodic Popul	$\bar{t} = 1.8 \quad \sigma = 0.6$	
EDISC	$Prd = 48.1 \text{ Mils}$ $\sigma = 35.8 \text{ Mils}$	Random Popul	$t = 0.0025(CTS Capacity)$	
IFI	$Prd = 19.2 \text{ Sec}$ $\sigma = 4.7 \text{ Sec}$	Random Popul	$\bar{t} = 1.0 \quad \sigma = 0.0$	
KIP	$Prd = 64.9 \text{ Mils}$	Periodic Popul	$t = 0.3(\#DBMs)$	
PSRAP	$Prd = 70.7 \text{ Mils}$	Periodic Popul	$\bar{t} = 19.5 \quad \sigma = 8.0 \quad (4 \text{ Snsr Sites})$ $\bar{t} = 9.8 \quad \sigma = 5.7 \quad (2 \text{ Snsr Sites})$ $\bar{t} = 4.9 \quad \sigma = 4.0 \quad (1 \text{ Snsr Sites})$	
MSP	$Prd = 48.6 \text{ Mils}$ $\sigma = 26.4 \text{ Mils}$	Random Popul		

PROCESSOR UTILIZATION MODELS (1984) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
Overhead for task initiation	Before each task		$\bar{t} = 0.33 \quad \sigma = 0.5$	
Lattice			$t_{\text{TIMEOUT}} = \begin{cases} 130 & \text{if Prcsng on Schedule} \\ 110 & \text{if 1 Sector late} \\ 85 & \text{if 2 Sectors late} \\ 60 & \text{if 3 Sectors late} \\ 35 & \text{if 4 Sectors late} \end{cases}$ <p>Lattice Execution Time is Compared to Timeout Value During PAUS Processing. If Elapsed Lattice Execution Time Exceeds Timeout, PAUS is Terminated.</p>	
CA	1/Sector/Snsr	1/Lattice/Snsr	$t(j) = 0.003 \sum_{k=1}^{32} \left[\frac{CTA(j,k)}{k-1} \right]^2 + 0.164 \sum_{k=1}^{32} CTA(j,k)$ <p>CTA(j,k) = Mode C Beacon Only Associated Tracks + Mode C Radar Reinforced Beacon Associated Tracks + Linked Unassociated Tracks on Sensor j in Sector k.</p>	$\bar{t} = 3$
CAIRP	1/Sector/Snsr	1/Lattice/Snsr	$t(j) = 2 \left[CTA(j,k) \right]$	$\bar{t} = 3$
CAU	1/Lattice	1/Lattice	$t = 2$	
BUUX	1/Lattice	1/Lattice	$t = 0.0066(CTS)$	

PROCESSOR UTILIZATION MODELS (1986)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
ALTRK	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 2.6 \quad \sigma = 0.4$	$\bar{t} = 1.3 \quad \sigma = .325$
AUT	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.5$	
COR	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
CRIT	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
DOP	1/Lattice	1/Lattice	$t = 1.4 (\#MDBMs)$	
IFI	1/Lattice	1/Lattice	$\bar{t} = 10.0 \quad \sigma = 3.0$	
IFO	1/Lattice	1/Lattice	$\bar{t} = 10.0 \quad \sigma = 3.0$	
KOFA	1/Lattice	1/Lattice	$\bar{t} = 5.4 \quad \sigma = 4.3$	
MAT	1/60 Seconds	1/Lattice	$t = 0.001 (\text{CTS Capacity})$ $(t_{MAX} = 32)$	$\bar{t} = 1.25 \quad \sigma = 0.425$
MSAW	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 1.8 \quad \sigma = 1.0$	$\bar{t} = 1.8 \quad \sigma = 1.0$
MTP	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
PAUS	P/Lattice (P=#Processors)	P/Lattice	$P \cdot \sum_{p=1}^{\#Snsr} t(p) = 0.0381 (\text{CTS}) + 0.625 (t_L) (T1)$ $T1 = \sum_{j=1}^{\#Snsr} \sum_{k=1}^{32} \bar{t}_s(j,k) \left[TA(j,k) \right] + \left[TU(j,k) \right] \left[\#Displays(j) \right]$	

TA = Associated Tracks
 TU = Unassociated Tracks
 j = Snsr ID
 k = Sector ID
 t_L = Execution Time of Previous Lattice
 t_s = Sensor Scan Time

PROCESSOR UTILIZATION MODELS (1986) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
PDOP	4/Second	1/Lattice	$t = 0.6(\#RDDMs)$	$\bar{t} = 1.7 \quad \sigma = 1.3$
RDOP	1/Lattice at Sites with RDDMs	1/Lattice at Sites with RDDMs	$t = 2.4(\#RDDMs)$	
RKIP	1/Lattice at Sites with RDDMs	1/Lattice at Sites with RDDMs	$t = 1.3(\#RDDMs)$	
RTDOP	1/Lattice at Sites with RDDMs	1/Lattice at Sites with RDDMs	$t = 0.6(\#RDDMs)$	
SCIME	Detroit: 1/Lat NY CHI LA } 3/Lat	Detroit: 1/Lat NY CHI LA } 3/Lat	$\sum_{i=1}^I t(i) = 0.0011(CTS \text{ Capacity})$ $I = \# \text{Executions/Lattice}$	
SLINK	1/Lattice at Multisnr Site	1/Lattice at Multisnr Site	$\bar{t} = 8.2 \quad \sigma = 2.7 \quad (t_{MAX} = 80)$	$\bar{t} = 1.0$
SWABS	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 1.0 \quad \sigma = 0.0 \quad (t_{MAX} = 64)$	
TCRSS	1/Sector/Snsr At NY Only	1/Lattice/Snsr At NY Only	$t = 3.7 + TII \quad (t_{MAX} = 90)$ $TII = \# \text{Unassociated Tracks in Sector Processed}$	$\bar{t} = 3.1 \quad \sigma = 1.3$
TDOP	NY: 5/Lattice CHI: 3/Lattice LA: 2/Lattice DET: 1/Lattice	NY: 5/Lattice CHI: 3/Lattice LA: 2/Lattice DET: 1/Lattice	$\sum_{i=1}^I t(i) = 0.6(\#RDDMs)$ $I = \# \text{Executions/Lattice}$	
TEDC	1/Sector/Snsr At NY Only	1/Lattice/Snsr At NY Only	$t = 1.7 + 0.55(ATD+UTD) + 0.2(TA)(TU)$ $(t_{MAX} = 60)$ $ATD = \# \text{Discrete Associated Tracks}$ $UTD = \# \text{Discrete Unassociated Tracks}$	$\bar{t} = 3.5 \quad \sigma = 2.5$

PROCESSOR UTILIZATION MODELS (1986) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
IFXEC	1/Lattice	1/Lattice	$t = 0.5(\#SNSRs)$	$\bar{t} = 3.2 \quad \sigma = 1.9$
TINIT	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 4.0 \quad \sigma = 4.1 \quad (t_{MAX} = 200)$	
TPRED	1/Sector/Snsr	1/Lattice/Snsr	$t = 3.1 + 1.3(TA+TU)$ $TA = \#Associated Tracks in Sector Processed$	$\bar{t} = 3.3 \quad \sigma = 1.8$
TPSEC	1/Sector/Snsr At NY Only	1/Lattice/Snsr At NY Only	$t = 7.8 + 0.5(TU)$	$\bar{t} = 3.4 \quad \sigma = 1.8$
TPUR	1/Sector/Snsr At NY Only	1/Lattice/Snsr At NY Only	$\bar{t} = 11.9 \quad \sigma = 10.9 \quad (t_{MAX} = 90)$	$\bar{t} = 3.2 \quad \sigma = 1.9$
TROUT	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 3.3 \quad \sigma = 1.7$	$\bar{t} = 2.9 \quad \sigma = 1.9$
TUPS	1/Lattice	1/Lattice	$t = 0.0066(CTS Capacity)$	
TUN	1/Lattice	1/Lattice	$t = 0.0038(CTS Capacity)$	
CDT	Prd = 1.3 Sec $\sigma = 0.79 Sec$	Random Popul	$\bar{t} = 3.6 \quad \sigma = 1.7$	
CTIP	Prd = 0.049 Sec	Periodic Popul	$\bar{t} = 1.8 \quad \sigma = 0.6$	
EDISC	Prd = 48.1 Mils $\sigma = 35.8 Mils$	Random Popul	$t = 0.0025(CTS Capacity)$	
IFT	Prd = 19.2 Sec $\sigma = 4.7 Sec$	Random Popul	$\bar{t} = 1.0 \quad \sigma = 0.0$	
KIP	Prd = 64.9 Mils	Periodic Popul	$t = 0.3(\#DBMs)$	
PSRAP	Prd = 70.7 Mils	Periodic Popul	$\bar{t} = 19.5 \quad \sigma = 8.0 \quad (4 Snsr Sites)$ $\bar{t} = 9.8 \quad \sigma = 5.7 \quad (2 Snsr Sites)$ $\bar{t} = 4.9 \quad \sigma = 4.0 \quad (1 Snsr Sites)$	
WSP	Prd = 48.6 Mils $\sigma = 26.4 Mils$	Random Popul	$\bar{t} = 4.0 \quad \sigma = 2.6$	

PROCESSOR UTILIZATION MODELS (1986) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
Overhead for Task Initiation	Before Each Task		$\bar{t} = 0.33 \quad \sigma = 0.5$	
Lattice			$t_{\text{TIMEOUT}} = \begin{cases} 130 \text{ if Prcsng on Schedule} \\ 110 \text{ if 1 Sector Late} \\ 85 \text{ if 2 Sectors Late} \\ 60 \text{ if 3 Sectors Late} \\ 35 \text{ if 4 Sectors Late} \end{cases}$ <p>Lattice Execution Time is Compared to Timeout Value During PAUS Processing if Elapsed Lattice Execution Time Exceeds Timeout, PAUS is Terminated,</p> $t(j) = 0.003 \sum_{k=1}^{32} \text{CTA}(j,k)^2 + 0.164 \sum_{k=1}^{32} \text{CTA}(j,k) \quad \bar{t} = 3$	
CA	1/Sector/Snsr	1/Lattice/Snsr	$\text{CTA}(j,k) = \text{Mode C Beacon Only Associated Tracks} + \text{Mode C Radar Reinforced Beacon Associated Tracks} + \text{Linked Unassociated Tracks on Sensor } j \text{ in Sector } k$	
CATR	1/Sector/Snsr	1/Lattice/Snsr	$t(j) = 2[\text{CTA}(j,k)]$	$\bar{t} = 3$
CATU	1/Lattice	1/Lattice	$\bar{t} = 2$	
TUDX	1/Lattice	1/Lattice	$t = 0.0066(\text{CTS})$	
PUTT	1/Lattice/Snsr At NV Only	1/Lattice/Snsr At NV Only	$t = 1$	
MS	Prd = 153.6Mils	Periodic Popul	$t = 0.11 + 1.7 \sum_{j=1}^{\# \text{Snsr } 32} \sum_{k=1}^{10} \text{TA}(j,k)$ <p>$j = \text{Sensor } 10$ $k = \text{Sector } 10$</p>	

PROCESSOR UTILIZATION MODELS (1986) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
DABC	1/Sector/Snsr Not implemented	1/Lattice/Snsr Not implemented at NY in '86	$t = 2.55 + 0.83(TA+TU) + 0.3(TA)(TU)$ TA = Associated Tracks in Sector TU = Unassociated Tracks in Sector	$\bar{t} = 3.5 \quad \sigma = 2.5$

PROCESSOR UTILIZATION MODELS (1988)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
AL TRK	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 2.6 \quad \sigma = 0.4$	$\bar{t} = 1.3 \quad \sigma = .325$
AUT	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.5$	
COR	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
CRIT	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
DDP	1/Lattice	1/Lattice	$\bar{t} = 1.4 (\#MDBMs)$	
IFI	1/Lattice	1/Lattice	$\bar{t} = 15.0 \quad \sigma = 3.0$	
IFO	1/Lattice	1/Lattice	$\bar{t} = 18.3 \quad \sigma = 3.0$	
KOFA	1/Lattice	1/Lattice	$\bar{t} = 5.4 \quad \sigma = 4.3$	
MAT	1/60 Seconds	1/Lattice	$t = 0.001(\text{CTS Capacity})$ $(t_{MAX} = 32)$	$\bar{t} = 1.25 \quad \sigma = 0.425$
MSAW	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 1.8 \quad \sigma = 1.0$	$\bar{t} = 1.8 \quad \sigma = 1.0$
MTP	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
PAUS	1/Lattice (P=#Processors)	P/Lattice	$t(p) = 0.0381(\text{CTS}) + 0.625(t_L)(T1)$ $T1 = \sum_{j=1}^{\#Snsr} \sum_{k=1}^{32} \bar{t}_S(j,k) \left[TA(j,k) \right] + \left[TU(j,k) \right] \left[\#Displays(j) \right]$ <p> TA = Associated Tracks TU = Unassociated Tracks j = Snsr ID k = Sector ID t_L = Execution Time of Previous Lattice t_S = Sensor Scan Time </p>	

PROCESSOR UTILIZATION MODELS (1988) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
PIOP	4/Second	1/Lattice	$t = 0.6(\#RDBMs)$	$\bar{t} = 1.7 \quad \sigma = 1.3$
RIOP	1/Lattice at Sites with RDBMs	1/Lattice at Sites with RDBMs	$t = 2.4(\#RDBMs)$	
RKIP	1/Lattice at Sites with RDBMs	1/Lattice at Sites with RDBMs	$t = 1.3(\#RDBMs)$	
RTDOP	1/Lattice at Sites with RDBMs	1/Lattice at Sites with RDBMs	$t = 0.6(\#RDBMs)$	
SCIME	Detroit: 1/Lat NY CHI LA	Detroit: 1/Lat NY CHI LA	$\sum_{i=1}^I t(i) = 0.0011(\text{CTS Capacity})$ $I = \# \text{Executions/Lattice}$	
SLINK	1/Lattice at Multisnr Site	1/Lattice at Multisnr Site	$\bar{t} = 8.2 \quad \sigma = 2.7 \quad (t_{MAX} = 80)$	$\bar{t} = 1.0$
SWAPS	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 1.0 \quad \sigma = 0.0 \quad (t_{MAX} = 64)$	
TDOP	NY: 5/Lattice CHI: 3/Lattice LA: 2/Lattice DET: 1/Lattice	NY: 5/Lattice CHI: 3/Lattice LA: 2/Lattice DET: 1/Lattice	$\sum_{i=1}^I t(i) = 0.6(\#RDBMs)$ $I = \# \text{Executions/Lattice}$	

PROCESSOR UTILIZATION MODELS (1988) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
TEXFC	1/Lattice	1/Lattice	$t = 0.5(\#Snsrs)$	$\bar{t} = 3.2 \quad \sigma = 1.9$
TINIT	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 4.0 \quad \sigma = 4.1 \quad (t_{MAX} = 200)$	
TPRED	1/Sector/Snsr	1/Lattice/Snsr	$t = 3.1 + 1.3(TA+TU)$ $TA = \#Associated Tracks in Sector Processed$	$\bar{t} = 3.3 \quad \sigma = 1.8$
TROUT	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 3.3 \quad \sigma = 1.7$	$\bar{t} = 2.9 \quad \sigma = 1.9$
TUDS	1/Lattice	1/Lattice	$t = 0.0066(CTS Capacity)$	
TUD	1/Lattice	1/Lattice	$t = 0.0038(CTS Capacity)$	
COT	Prd = 1.3 Sec $\sigma = 0.79 Sec$	Random Popul	$\bar{t} = 3.6 \quad \sigma = 1.7$	
CTIP	Prd = 0.049 Sec	Periodic Popul	$\bar{t} = 1.8 \quad \sigma = 0.6$	
EOISC	Prd = 48.1 Mils $\sigma = 35.8 Mils$	Random Popul	$t = 0.0025(CTS Capacity)$	
IFI	Prd = 19.2 Sec $\sigma = 4.7 Sec$	Random Popul	$\bar{t} = 1.0 \quad \sigma = 0.0$	
KIP	Prd = 64.9 Mils	Periodic Popul	$t = 0.3(\#DBMs)$	
PSRAP	Prd = 70.7 Mils	Periodic Popul	$\bar{t} = 19.5 \quad \sigma = 8.0 (4 Snsr Sites)$ $\bar{t} = 9.8 \quad \sigma = 5.7 (2 Snsr Sites)$ $\bar{t} = 4.9 \quad \sigma = 4.0 (1 Snsr Sites)$	
MSP	Prd = 48.6 Mils $\sigma = 26.4 Mils$	Random Popul	$\bar{t} = 4.0 \quad \sigma = 2.6$	

PROCESSOR UTILIZATION MODELS (1988) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
Overhead for task Initiation	Before Each Task		$\bar{t} = 0.33 \quad u = 0.5$	
Lattice			$t_{\text{TIMEOUT}} = \begin{cases} 130 & \text{if Procsg on Schedule} \\ 110 & \text{if 1 Sector Late} \\ 85 & \text{if 2 Sectors Late} \\ 60 & \text{if 3 Sectors Late} \\ 35 & \text{if 4 Sectors Late} \end{cases}$ <p>Lattice Execution Time is Compared to Timeout Value During PAUS Processing if Elapsed Lattice Execution Time Exceeds Timeout, PAUS is Terminated.</p>	
CA	1/Sector/Snsr	1/Lattice/Snsr	$t(j) = 0.003 \left[\sum_{k=1}^{32} \text{CTA}(j,k) \right]^2 + 0.164 \sum_{k=1}^{32} \text{CTA}(j,k)$ <p>CTA(j,k) = Mode C Beacon Only Associated Tracks + Mode C Radar Reinforced Beacon Associated Tracks + Linked Unassociated Tracks on Sensor j in Sector k</p>	$\bar{t} = 3$
CAIRK	1/Sector/Snsr	1/Lattice/Snsr	$t(j) = 2 \left[\text{CTA}(j,k) \right]$	$\bar{t} = 3$
CAIU	1/Lattice	1/Lattice	$\bar{t} = 2$	
TDUX	1/Lattice	1/Lattice	$t = 0.0066(\text{CTS})_{\text{Snsr}} \sum_{j=1}^{32} \text{TA}(j,k)$	
HS	Prd=153.6 MILs	Periodic Popup	$t = 0.11 + 1.7 \sum_{j=1}^{32} \text{TA}(j,k)$ <p>j = Sensor ID k = Sector ID</p>	

PROCESSOR UTILIZATION MODELS (1908) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
DABC	1/Sector/Snsr	1/Lattice/Snsr	$t = 2.55 + 0.83(TA+TU) + 0.3(TA)(TU)$ TA = Associated Tracks in Sector TU = Unassociated Tracks in Sector	$t = 3.5$ $\sigma = 2.5$

PROCESSOR UTILIZATION MODELS (1990)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
AI TRK	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 2.6 \quad \sigma = 0.4$	$\bar{t} = 1.3 \quad \sigma = .325$
AUF	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.5$	
COR	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
CRIT	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
DOP	1/Lattice	1/Lattice	$t = 1.4(\#MDDMs)$	
IFI	1/Lattice	1/Lattice	$\bar{t} = 15.0 \quad \sigma = 3.0$	
IFO	1/Lattice	1/Lattice	$\bar{t} = 18.3 \quad \sigma = 3.0$	
KOTA	1/Lattice	1/Lattice	$\bar{t} = 5.4 \quad \sigma = 4.3$	
MAT	1/60 Seconds	1/Lattice	$t = 0.001(\text{CTS Capacity})$ $(t_{MAX} = 32)$	$\bar{t} = 1.25 \quad \sigma = 0.425$
MSAW	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 1.8 \quad \sigma = 1.0$	$\bar{t} = 1.8 \quad \sigma = 1.0$
MIP	1/Lattice	1/Lattice	$\bar{t} = 1.0 \quad \sigma = 0.0$	
PAUS	1/Lattice (p-#Processors)	P/Lattice	$t(p) = 0.0381(\text{CTS}) + 0.625(t_L)(T1)$ $T1 = \sum_{j=1}^{\#Snsr} \sum_{k=1}^{32} \frac{1}{t_s(j)} \left[TA(j,k) \right] + \left[TU(j,k) \right] \left[\#Displays(j) \right]$ <p> TA = Associated Tracks TU = Unassociated Tracks j = Snsr ID k = Sector ID t_L = Execution Time of Previous Lattice t_s = Sensor Scan Time </p>	

PROCESSOR UTILIZATION MODELS (1990) (CONT'D.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
PDOP	4/Second	1/Lattice	$t = 0.6(\#RDMS)$	$\bar{t} = 1.7 \quad \sigma = 1.3$
RDOP	1/Lattice at Sites with RDMS	1/Lattice at Sites with RDMS	$t = 2.4(\#RDMS)$	
RKIP	1/Lattice at Sites with RDMS	1/Lattice at Sites with RDMS	$t = 1.3(\#RDMS)$	
RTDOP	1/Lattice at Sites with RDMS	1/Lattice at Sites with RDMS	$t = 0.6(\#RDMS)$	
SCIME	Detroit: 1/Lat NY CHI LA 3/Lat	Detroit: 1/Lat NY CHI LA 3/Lat	$\sum_{i=1}^I t(i) = 0.0011(CIS \text{ Capacity})$ $I = \# \text{Executions/Lattice}$	
SLINK	1/Lattice at Multisnr Site	1/Lattice at Multisnr Site	$\bar{t} = 8.2 \quad \sigma = 2.7 \quad (t_{MAX} = 80)$	
SWAPS	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 1.0 \quad \sigma = 0.0 \quad (t_{MAX} = 64)$	$\bar{t} = 1.0$
			$TU = \# \text{Unassociated Tracks in Sector Processed}$	
TOOP	NY: 5/Lattice CHI: 3/Lattice LA: 2/Lattice DET: 1/Lattice	NY: 5/Lattice CHI: 3/Lattice LA: 2/Lattice DET: 1/Lattice	$\sum_{i=1}^I t(i) = 0.6(\#RDMS)$ $I = \# \text{Executions/Lattice}$	

PROCESSOR UTILIZATION MODELS (1990) (Cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
TEXEC	1/Lattice	1/Lattice	$t = 0.5(\#SNSRs)$	$\bar{t} = 3.2 \quad \sigma = 1.9$
TIMIT	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 4.0 \quad \sigma = 4.1 \quad (t_{MAX} = 200)$	
TPRED	1/Sector/Snsr	1/Lattice/Snsr	$t = 3.1 + 1.3(TA+TU)$ $TA = \#Associated Tracks in Sector Processed$	$\bar{t} = 3.3 \quad \sigma = 1.8$
TROUT	1/Sector/Snsr	1/Lattice/Snsr	$\bar{t} = 3.3 \quad \sigma = 1.7$	$\bar{t} = 2.9 \quad \sigma = 1.9$
TUDS	1/Lattice	1/Lattice	$t = 0.0066(CTS Capacity)$	
TUD	1/Lattice	1/Lattice	$t = 0.0038(CTS Capacity)$	
CDT	Prd = 1.3 Sec $\sigma = 0.79 Sec$	Random Popul	$\bar{t} = 3.6 \quad \sigma = 1.7$	
CTIP	Prd=0.049 Sec	Periodic Popul	$\bar{t} = 1.8 \quad \sigma = 0.6$	
EDISC	Prd=48.1 Mils $\sigma = 35.8 Mils$	Random Popul	$t = 0.0025(CTS Capacity)$	
IFI	Prd=19.2 Sec $\sigma = 4.7 Sec$	Random Popul	$\bar{t} = 1.0 \quad \sigma = 0.0$	
KIP	Prd=64.9 Mils	Periodic Popul	$t = 0.3(\#DBMs)$	
PSRAP	Prd=70.7 Mils	Periodic Popul	$\bar{t} = 19.5 \quad \sigma = 8.0 (4 Snsr Sites)$ $\bar{t} = 9.8 \quad \sigma = 5.7 (2 Snsr Sites)$ $\bar{t} = 4.9 \quad \sigma = 4.0 (1 Snsr Sites)$	
MSP	Prd=48.6 Mils $\sigma = 26.4 Mils$	Periodic Popul	$\bar{t} = 4.0 \quad \sigma = 2.6$	

PROCESSOR UTILIZATION MODELS (1990) (Cont'd.)

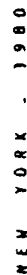
FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MILS) WHEN EXECUTED	PROCESS TIME (MILS) WHEN INITIATED BUT NOT EXECUTED
Overhead for Task Initiation	Before Each Task		$\bar{t} = 0.33 \quad \sigma = 0.5$	
Lattice			$t_{\text{TIMEOUT}} = \begin{cases} 130 \text{ if Prcsng on Schedule} \\ 110 \text{ if 1 Sector Late} \\ 85 \text{ if 2 Sectors Late} \\ 60 \text{ if 3 Sectors Late} \\ 35 \text{ if 4 Sectors Late} \end{cases}$ <p>Lattice Execution Time is Compared to Timeout Value During PAUS Processing if Elapsed Lattice Execution Time Exceeds Timeout, PAUS is Terminated.</p>	
CA	1/Sector/Snsr	1/Lattice/Snsr	$t(j) = 0.003 \left[\sum_{k=1}^{32} \text{CTA}(j,k) \right]^2 + 0.164 \sum_{k=1}^{32} \text{CTA}(j,k)$ <p>CTA(j,k) = Mode C Beacon Only Associated Tracks + Mode C Radar Reinforced Beacon Associated Tracks + Linked Unassociated Tracks on Sensor j in Sector k</p>	$\bar{t} = 3$
CATR	1/Sector/Snsr	1/Lattice/Snsr	$t(j) = 2 \left[\text{CTA}(j,k) \right]$	$\bar{t} = 3$
CATU	1/Lattice	1/Lattice	$\bar{t} = 2$	
INDX	1/Lattice	1/Lattice	$t = 0.0066(\text{CTS}) \sum_{j=1}^{\# \text{Snsr}} \sum_{k=1}^{32} \text{TA}(j,k)$	
MS	Prd=153.6 Mils	Periodic Popup	$t = 0.11 + 1.7 \sum_{j=1}^{\# \text{Snsr}} \sum_{k=1}^{32} \text{TA}(j,k)$ <p>j = Sensor ID k = Sector ID</p>	

PROCESSOR UTILIZATION MODELS (1990) (cont'd.)

FUNCTION	FREQUENCY EXECUTED	FREQUENCY INITIATED	PROCESS TIME (MIS) WHEN EXECUTED	PROCESS TIME (MIS) WHEN INITIATED BUT NOT EXECUTED
DABC	1/Sector/Snsr	1/Lattice/Snsr	$t = 2.55 + 0.83(TA+TU) + 0.3(TA)(TU)$ TA = Associated Tracks in Sector TU = Unassociated Tracks in Sector	$E = 3.5 \quad u = 2.5$

APPENDIX M

LATTICE DESCRIPTIONS FOR THE NEW YORK TRACON



LATTICE STRUCTURE
NEW YORK 1980

TASK	SUCCESSORS							
TEVEC	TINIT1 TPSEC1 TPSEC2 TPSEC3 TPSEC4	TROUT1 TCRSS1 TCRSS2 TCRSS3 TCRSS4	TINIT3 TEDC1 TEDC2 TEDC3 TEDC4	TROUT3 TPRED1 TPRED2 TPRED3 TPRED4	TINIT2 TPUR1 TPUR2 TPUR3 TPUR4	TROUT2 ALTRK1 ALTRK2 ALTRK3 ALTRK4	TINIT4 MSAW1 MSAW2 MSAW3 MSAW4	TROUT4 SWABS1 SWABS2 SWABS3 SWABS4
TUD	CRIT TPUR2	IFO SWABS2	AUT TPRED3	SLINK TPUR3	TPRED1 SWABS3	TPUR1 TPRED4	SWABS1 TPUR4	TPRED2 SWABS4
TUOS	TINIT1 TPSEC1 TPSEC2 TPSEC3 TPSEC4	TROUT1 TCRSS1 TCRSS2 TCRSS3 TCRSS4	TINIT3 TEDC1 TEDC2 TEDC3 TEDC4	TROUT3 TPRED1 TPRED2 TPRED3 TPRED4	TINIT2 TPUR1 TPUR2 TPUR3 TPUR4	TROUT2 ALTRK1 ALTRK2 ALTRK3 ALTRK4	TINIT4 MSAW1 MSAW2 MSAW3 MSAW4	TROUT4 SQABS1 SWABS2 SWABS3 SWABS4
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	TINIT1	TROUT1	TINIT3	TROUT3	TINIT2	TROUT2	TINIT4	TROUT4
IFO	IFI							
TINIT1	MAT							
TINIT2	MAT							
TINIT3	MAT							
TINIT4	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS3	PAUS4	PAUS7	SCTME1
TROUT2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT4	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	TDOP4	RTDOP	TDOP2	TDOP5	TDOP3		
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1

LATTICE STRUCTURE
NEW YORK 1980 (Cont'd.)

<u>TASK</u>	<u>SUCCESSORS</u>							
TDOP2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP4	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP5	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TPRED1								
SWABS1								
TPUR1								
TPRED2								
SWABS2								
TPUR2								
TPRED3								
SWABS3								
TPUR3								
TPRED4								
SWABS4								
TPUR4								
TCRSS1								
TEDC1								
TPSEC1								
MSAW1								
ALTRK1								
TCRSS2								
TEDC2								
TPSEC2								
MSAW2								
ALTRK2								
TCRSS3								
TEDC3								
TPSEC3								
MSAW3								
ALTRK3								
TCRSS4								
TEDC4								
TPSEC4								
MSAW4								
ALTRK4								
AUT								
SLINK								

LATTICE STRUCTURE
NEW YORK 1980 (Cont'd.)

TASK

SUCCESSORS

PAUS1
PAUS2
PAUS3
PAUS4
PAUS5
PAUS6
PAUS7
SCTME1
SCTME2
SCTME3

AD-A087 243

STERLING SYSTEMS INC WASHINGTON DC

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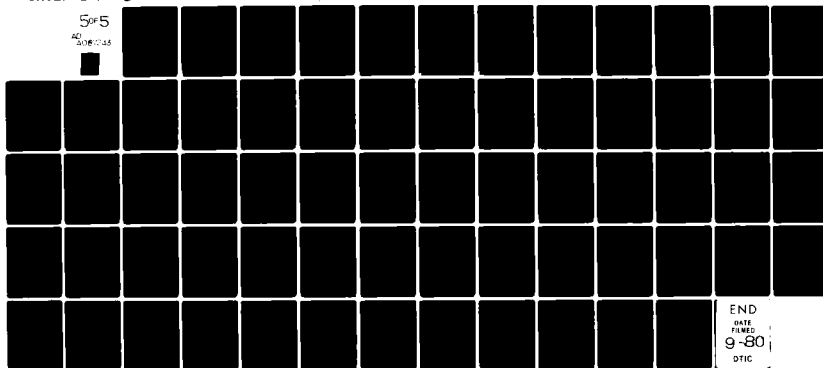
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LATTICE STRUCTURE

NEW YORK 1982

<u>TASK</u>	<u>SUCCESSORS</u>							
TEXEC	TINIT1 CA1 TPUR1 TPUR2 TPUR4	TROUT1 CA2 ALTRK1 ALTRK2 ALTRK4	TINIT3 CA3 MSAW1 MSAW2 MSAW4	TROUT3 CA4 SWABS1 SWABS2 SWABS4	TINIT2 TPSEC1 TPSEC2 TPSEC3	TROUT2 TCRSS1 TCRSS2 TCRSS3	TINIT4 TEDC1 TEDC2 TEDC3	TROUT4 TPRED1 TPRED2 TPRED3
TUD	CRIT TPUR2	IFO SWABS2	AUT TPRED3	SLINK TPUR3	TPRED1 SWABS3	TPUR1 TPRED4	SWABS1 TPUR4	TPRED2 SWABS4
TUDS	TINIT1 CA1 TPUR1 TPUR2 TPUR3 TPUR4	TROUT1 CA2 ALTRK1 ALTRK2 ALTRK3 ALTRK4	TINIT3 CA3 MSAW1 MSAW2 MSAW3 MSAW4	TROUT3 CA4 SWABS1 SWABS2 SWABS3 SWABS4	TINIT2 TPSEC1 TPSEC2 TPSEC3 TPSEC4	TROUT2 TCRSS1 TCRSS2 TCRSS3 TCRSS4	TINIT4 TEDC1 TEDC2 TEDC3 TEDC4	TROUT4 TPRED1 TPRED2 TPRED3 TPRED4
TUDX	CA1	CA2	CA3	CA4				
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	TINIT1	TROUT1	TINIT3	TROUT3	TINIT2	TROUT2	TINIT4	TROUT4
IFO	IFI							
TINIT1	MAT							
TINIT2	MAT							
TINIT3	MAT							
TINIT4	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT4	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	TDOP4	RTDOP	TDOP2	TDOP5	TDOP3		

LATTICE STRUCTURE
NEW YORK 1982 (Cont'd.)

<u>TASK</u>	<u>SUCCESSORS</u>							
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP4	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP5	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1 CA2	CATRK2	CATU						
CATRK2 CA3	CATRK3	CATU						
CATRK3 CA4	CATRK4	CATU						
CATRK4 TPRED1 SWABS1 TPUR1 TPRED2 SWABS2 TPUR2 TPRED3 SWABS3 TPUR3 TPRED4 SWABS4 TPUR4 TCRSS1 TEDC1 TPSEC1 MSAW1 ALTRK1 TCRSS2 TEDC2 TPSEC2 MSAW2 ALTRK2 TCRSS3 TEDC3								

LATTICE STRUCTURE
NEW YORK 1982 (Cont'd.)

TASK

SUCCESSORS

TPSEC3
MSAW3
ALTRK3
TCRSS4
TEDC4
TPSEC4
MSAW4
ALTRK4
AUT
SLINK
CATU
PAUS1
PAUS2
PAUS3
PAUS4
PAUS5
PAUS6
PAUS7
SCTME1
SCTME2
SCTME3

LATTICE STRUCTURE

NEW YORK 1984

<u>TASK</u>	<u>SUCCESSORS</u>							
TEXEC	TINIT1 CA1 TPUR1 TPUR2 TPUR3 TPUR4	TROUT1 CA2 ALTRK1 ALTRK2 ALTRK3 ALTRK4	TINIT3 CA3 MSAW1 MSAW2 MSAW3 MSAW4	TROUT3 CA4 SWABS1 SWABS2 SWABS3 SWABS4	TINIT2 TPSEC1 TPSEC2 TPSEC3 TPSEC4	TROUT2 TCRSS1 TCRSS2 TCRSS3 TCRSS4	TINIT4 TEDC1 TEDC2 TEDC3 TEDC4	TROUT4 TPRED1 TPRED2 TPRED3 TPRED4
TUD	CRIT TPUR2	IFO SWABS2	AUT TPRED3	SLINK TPUR3	TPRED1 SWABS3	TPUR1 TPRED4	SWABS1 TPUR4	TPRED2 SWABS4
TUDS	TINIT1 CA1 TPUR1 TPUR2 TPUR3 TPUR4	TROUT1 CA2 ALTRK1 ALTRK2 ALTRK3 ALTRK4	TINIT3 CA3 MSAW1 MSAW2 MSAW3 MSAW4	TROUT3 CA4 SWABS1 SWABS2 SWABS3 SWABS4	TINIT2 TPSEC1 TPSEC2 TPSEC3 TPSEC4	TINIT4 TCRSS1 TCRSS2 TCRSS3 TCRSS4	TROUT4 TEDC1 TEDC2 TEDC3 TEDC4	TPRED1 TPRED2 TPRED3 TPRED4
TUDX	CA1	CA2	CA3	CA4				
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	TINIT1	TROUT1	TINIT3	TROUT3	TINIT2	TROUT2	TINIT4	TROUT4
IFO	IFI							
TINIT1	MAT							
TINIT2	MAT							
TINIT3	MAT							
TINIT4	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PASU4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT4	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	TDOP4	RTDOP	TDOP2	TDOP5	TDOP3		

LATTICE STRUCTURE
NEW YORK 1984 (Cont'd.)

<u>TASK</u>	<u>SUCCESSORS</u>							
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP4	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP5	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1 CA2	CATRK2	CATU						
CATRK2 CA3	CATRK3	CATU						
CATRK3 CA4	CATRK4	CATU						
CATRK4 TPRED1 SWABS1 TPUR1	PUTT1							
PUTT1 TPRED2 SWABS2 TPUR2	PUTT2							
PUTT2 TPRED3 SWABS3 TPUR3	PUTT3							
PUTT3 TPRED4 SWABS4 TPUR4	PUTT4							
PUTT4 TCRSS1 TEDC1 TPSEC1 MSAW1 ALTRK1								

LATTICE STRUCTURE
NEW YORK 1984 (Cont'd.)

TASK

SUCCESSOR

TCRSS2
TEDC2
TPSEC2
MSAW2
ATLRK2
TCRSS3
TEDC3
TPSEC3
MSAW3
ALTRK3
TCRSS4
TEDC4
TPSEC4
MSAW4
ALTRK4
AUT
SLINK
CATU
PAUS1
PAUS2
PAUS3
PAUS4
PAUS5
PAUS6
PAUS7
SCTME1
SCTME2
SCTME3

LATTICE STRUCTURE
NEW YORK 1986

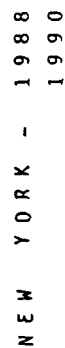
<u>TASK</u>	<u>SUCCESSORS</u>							
TExec	TINIT1 CA1 TPUR1 TPUR2 TPUR3 TPUR4	TROUT1 CA2 ALTRK1 ALTRK2 ALTRK3 ALTRK4	TINIT3 CA3 MSAW1 MSAW2 MSAW3 MSAW4	TROUT3 CA4 SWABS1 SWABS2 SWABS3 SWABS4	TINIT2 TPSEC1 TPSEC2 TPSEC3 TPSEC4	TROUT2 TCRSS1 TCRSS2 TCRSS3 TCRSS4	TINIT4 TEDC1 TEDC2 TEDC3 TEDC4	TROUT4 TPRED1 TPRED2 TPRED3 TPRED4
TUD	CRIT TPUR2	IFO SWABS2	AUT TPRED3	SLINK TPUR3	TPRED1 SWABS3	TPUR1 TPRED4	SWABS1 TPUR4	TPRED2 SWABS4
TUDS	TINIT1 CA1 TPUR1 TPUR2 TPUR3 TPUR4	TROUT1 CA2 ALTRK1 ALTRK2 ALTRK3 ALTRK4	TINIT3 CA3 MSAW1 MSAW2 MSAW3 MSAW4	TROUT3 CA4 SWABS1 SWABS2 SWABS3 SWABS4	TINIT2 TPSEC1 TPSEC2 TPSEC3 TPSEC4	TROUT2 TCRSS1 TCRSS2 TCRSS3 TCRSS4	TINIT4 TEDC1 TEDC2 TEDC3 TEDC4	TROUT4 TPRED1 TPRED2 TPRED3 TPRED4
TUDX	CA1	CA2	CA3	CA4				
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	TINIT1	TROUT1	TINIT3	TROUT3	TINIT2	TROUT2	TINIT4	TROUT4
IFO	IFI							
TINIT1	MAT							
TINIT2	MAT							
TINIT3	MAT							
TINIT4	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT4	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	TDOP4	RTDOP	TDOP2	TDOP5	TDOP3		

LATTICE STRUCTURE
NEW YORK 1986 (Cont'd.)

<u>TASK</u>	<u>SUCCESSORS</u>							
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP4	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP5	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1 CA2	CATRK2	CATU						
CATRK2 CA3	CATRK3	CATU						
CATRK3 CA4	CATRK4	CATU						
CATRK4 TPRED1 SWABS1 TPUR1	PUTT1							
PUTT1 TPRED2 SWABS1 TPUR1	PUTT1							
PUTT1 TPRED2 SWABS2 TPUR2	PUTT2							
PUTT2 TPRED3 SWABS3 TPUR3	PUTT3							
PUTT3 TPRED4 SWABS4 TPUR4	PUTT4							

LATTICE STRUCTURE
NEW YORK 1986 (Cont'd.)

<u>TASK</u>	<u>SUCCESSORS</u>
PUTT4	
TCRSS1	
TEDC1	
TPSEC1	
MSAW1	
ALTRK1	
TCRSS2	
TEDC2	
TPSEC2	
MSAW2	
ALTRK2	
TCRSS3	
TEDC3	
TPSEC3	
MSAW3	
ALTRK3	
TCRSS4	
TEDC4	
TPSEC4	
MSAW4	
ALTRK4	
AUT	
SLINK	
CATU	
PAUS1	
PAUS2	
PAUS3	
PAUS4	
PAUS5	
PAUS6	
PAUS7	
SCTME1	
SCTME2	
SCTME3	



LATTICE STRUCTURE

NEW YORK 1988

<u>TASK</u>	<u>SUCCESSORS</u>							
TEEXEC	DINIT1 CA1 SWABS1 ALTRK3	TROUT1 CA2 DABC2 MSAW3	DINIT3 CA3 TPRED2 SWABS3	TROUT3 CA4 ALTRK2 DABC4	DINIT2 DABC1 MSAW2 TPRED4	TROUT2 TPRED1 SWABS2 ALTRK4	DINIT4 ALTRK1 DABC3 MSAW4	TROUT4 MSAW1 TPRED3 SWABS4
TUD	CRIT TPRED3	IFO SWABS3	AUT TPRED4	SLINK SWABS4	TPRED1	SWABS1	TPRED2	SWABS2
TUDS	DINIT1 CA1 SWABS1 ALTRK3	TROUT1 CA2 DABC2 MSAW3	DINIT3 CA3 TPRED2 SWABS3	TROUT3 CA4 ALTRK2 DABC4	DINIT2 DABC1 MSAW2 TPRED4	TROUT2 TPRED1 SWABS2 ALTRK4	DINIT4 ALTRK1 DABC3 MSAW4	TROUT4 MSAW1 TPRED3 SWABS4
TUDX	CA1	CA2	C A3	CA4				
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	DINIT1	TROUT1	DINIT3	TROUT3	DINIT2	TROUT2	DINIT4	TROUT4
IFO	IFI							
DINIT1	MAT							
DINIT2	MAT							
DINIT3	MAT							
DINIT4	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT2	PAUS1 sctme2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT4	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	TDOP4	TRDOP	TDOP2	TDOP5	TDOP3		
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1

LATTICE STRUCTURE
NEW YORK 1988 (Cont'd.)

<u>TASK</u>	<u>SUCCESSORS</u>							
TDOP2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP4	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP5	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1 CA2	CATRK2	CATU						
CATRK2 CA3	CATRK3	CATU						
CATRK3 CA4	CATRK4	CATU						
CATRK4								
TPRED1								
SWABS1								
TPRED2								
SWABS2								
TPRED3								
SWABS3								
TPRED4								
SWABS4								
DABC1								
MSAW1								
ALTRK1								
DABC2								
MSAW2								
ALTRK2								
DABC3								
MSAW3								
ALTRK3								
DABC4								
MSAW4								
ALTRK4								
AUT								
SLINK								
CATU								
PAUD1								
PAUS2								

LATTICE STRUCTURE
NEW YORK 1988 (Cont'd.)

TASK

SUCCESSORS

OAYS3
PAUS4
PAUS5
PAUS6
PAUS7
SCTME1
SCTME2
SCTME3

LATTICE STRUCTURE

NEW YORK 1990

<u>TASK</u>	<u>SUCCESSORS</u>							
TEEXEC	DINIT1 CA1 SWABS1 ALTRK3	TROUT1 CA2 DABC2 MSAW3	DINIT3 CA3 TPRED2 SWABS3	TROUT3 CA4 ALTRK2 DABC4	DINIT2 DABC1 MSAW2 TPRED4	TROUT2 TPRED1 SWABS2 ALTRK4	DINIT4 ALTRK1 DABC3 MSAW4	TROUT4 MSAW1 TPRED3 SWABS4
TUD	CRIT TPRED3	IFO SWABS3	AUT TPRED4	SLINK SWABS4	TPRED1	SWABS1	TPRED2	SWABS2
TUDS	DINIT1 CA1 SWABS1 ALTRK3	TROUT1 CA2 DABC2 MSAW3	DINIT3 CA3 TPRED2 SWABS3	TROUT3 CA4 ALTRK2 DABC4	DINIT2 DABC1 MSAW2 TPRED4	TROUT2 TPRED1 SWABS2 ALTRK4	DINIT4 ALTRK1 DABC3 MSAW4	TROUT4 MSAW1 TPRED3 SWABS4
TUDX	CA1	CA2	CA3	CA4				
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	DINIT1	TROUT1	DINIT3	TROUT3	DINIT2	TROUT2	DINIT4	TROUT4
IFO	IFI							
DINIT1	MAT							
DINIT2	MAT							
DINIT3	MAT							
DINIT4	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT4	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	TDOP4	RTDOP	TDOP2	TDOP5	TDOP3		
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1

LATTICE STRUCTURE
NEW YORK 1990 (Cont'd.)

<u>TASK</u>	<u>SUCCESSORS</u>							
TDOP2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP4	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP5	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1 CA2	CATRK2	CATU						
CATRK2 CA3	CATRK3	CATU						
CATRK3 CA4	CATRK4	CATU						
CATRK4								
TPRED1								
SWABS1								
TPRED2								
SWABS2								
TPRED3								
SWABS3								
TPRED4								
SWABS4								
DABC1								
MSAW1								
ALTRK1								
DABC2								
MSAW2								
ALTRK2								
DABC3								
MSAW3								
ALTRK3								
DABC4								
MSAW4								
ALTRK4								
AUT								
SLINK								
CATU								
PAUS1								
PAUS2								

LATTICE STRUCTURE
NEW YORK 1990 (Cont'd.)

TASK

PAUS3
PAUS4
PAUS5
PAUS6
PAUS7
SCTME1
SCTME2
SCTME3

SUCCESSORS

APPENDIX N

LATTICE DESCRIPTIONS FOR THE CHICAGO TRACON



N-2

LATTICE STRUCTURE
CHICAGO 1982

<u>TASK</u>	<u>SUCCESSORS</u>							
TEXEC	TINIT1 TEDC1 TEDC1	TROUT1 TPRED1 TPRED2	TINIT2 TPUR1 TPUR2	TROUT2 ALTRK1 ALTRK2	CA1 MSAW1 MSAW2	CA2 SWABS1 SWABS2	TPSEC1 TPSEC2	TCRSS1 TCRSS2
TUD	CRIT TPUR2	IFO SWABS2	AUT	SLINK	TPRED1	TPUR1	SWABS1	TPRED2
TUDS	TINIT1 TEDC1 TEDC2	TROUT1 TPRED1 TPRED2	TINIT2 TPUR1 TPUR2	TROUT2 ALTRK1 ALTRK2	CA1 MSAW1 MSAW2	CA2 SWABS1 SWABS2	TPSEC1 TPSEC2	TRSS1 TCRSS2
TUDX	CA1	CA2						
DOP								
DCR								
PDOP								
CRIT	TINIT1	TROUT1	TINIT2	TROUT2				
IFO	IFI							
TINIT1	MAT							
TINTI2	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	TDOP2	TDOP3					
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1								
CA2	CATRK2	CATU						
CATRK1								
TPRED1								
SWABS1								
TPUR1								

LATTICE STRUCTURE
CHICAGO 1982 (Cont'd.)

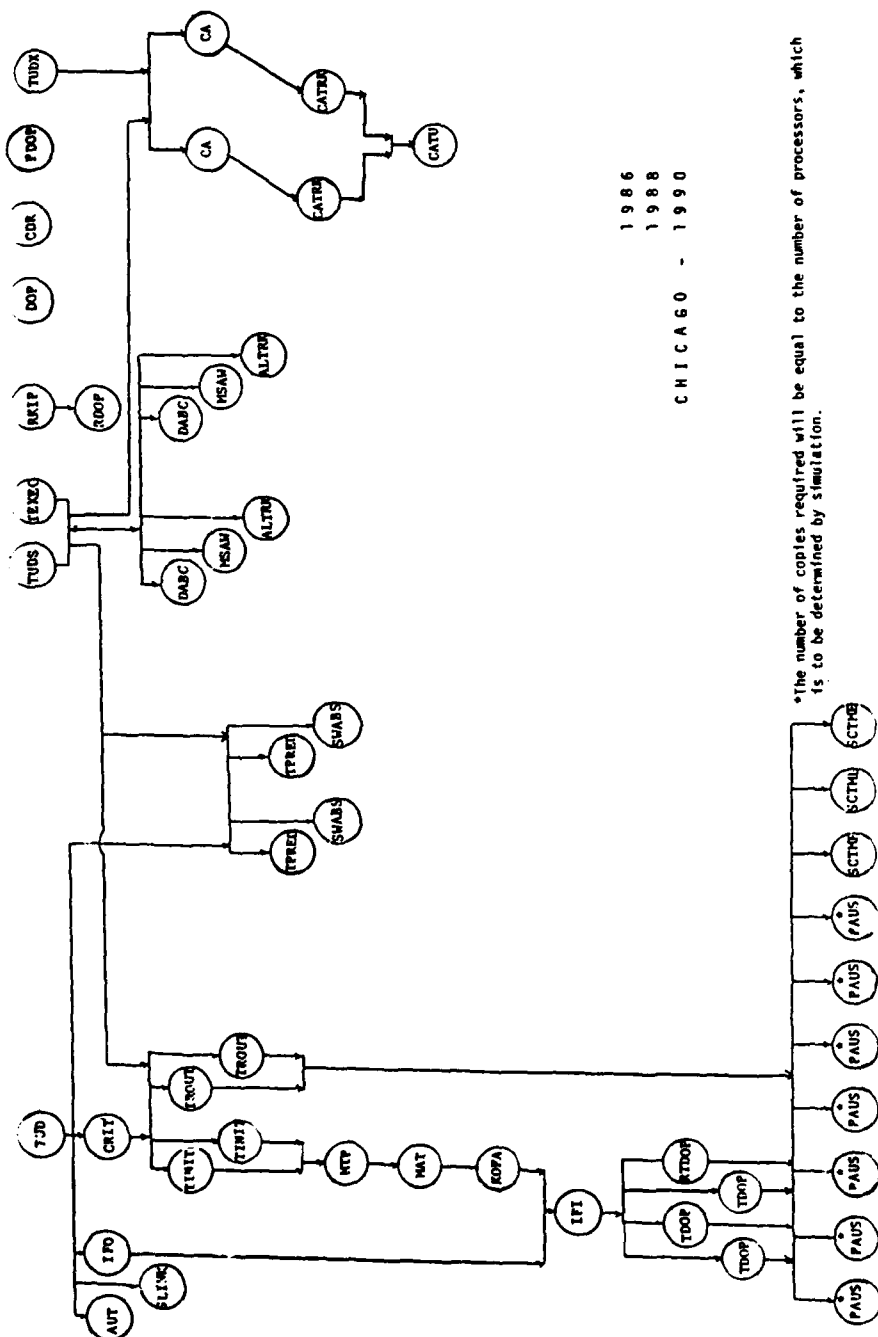
<u>TASK</u>	<u>SUCCESSORS</u>
TPRED2	
SWABS2	
TPUR2	
TCRSS1	
TEDC1	
TPSEC1	
MSAW1	
ALTRK1	
TCRSS2	
TEDC2	
TPSEC2	
MSAW2	
ALTRK2	
AUT	
SLINK	
CATU	
PAUS1	
PAUS2	
PAUS3	
PAUS4	*INHIBITED*
PAUS5	*INHIBITED*
PAUS6	*INHIBITED*
PAUS7	*INHIBITED*
SCTME1	
SCTME2	
SCTME3	

LATTICE STRUCTURE
CHICAGO 1984

<u>TASK</u>	<u>SUCCESSORS</u>							
TEEXEC	TINIT1 TEDC1 TEDC2	TROUT1 TPRED1 TPRED2	TINIT2 TPUR1 TPUR2	TROUT2 ALTRK1 ALTRK2	CA1 MSAW1 MSAW2	CA2 SWABS1 SWABS2	TPSEC1 TPSEC2	TCRSS1 TCRSS2
TUD	CRIT TPUR2	IFO SWABS2	AUT	SLINK	TPRED1	TPUR1	SWABS1	TPRED2
TUDS	TINIT1 TEDC1 TEDC2	TROUT1 TPRED1 TPRED2	TINIT2 TPUR1 TPUR2	TROUT2 ALTRK1 ALTRK2	CA1 MSAW1 MSAW2	CA2 SWABS1 SWABS2	TPSEC1 TPSEC2	TCRSS1 TCRSS2
TUDX	CA1	CA2						
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	TINIT1	TROUT1	TINIT2	TROUT2				
IFO	IFI							
TINIT1	MAT							
TINIT2	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	RTDOP	TDOP2	TDOP3				
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATR1	CATU						
CATR1								
CA2	CATR2	CATU						

LATTICE STRUCTURE
CHICAGO 1984 (Cont'd.)

<u>TASK</u>	<u>SUCCESSORS</u>
CATRK2	
TPRED1	
SWABS1	
TPUR1	PUTT1
PUTT1	
TPRED2	
SWABS2	
TPUR2	PUTT2
PUTT2	
TCRSS1	
TEDC1	
TPSEC1	
MSAW1	
ALTRK1	
TCRSS2	
TEDC2	
TPSEC2	
MSAW2	
ALTRK2	
AUT	
SLINK	
CATU	
PAUS1	
PAUS2	
PAUS3	
PAUS4	
PAUS5	*INHIBITED*
PAUS6	*INHIBITED*
PAUS7	*INHIBITED*
SCTME1	
SCTME2	
SCTME3	



1986	1988	1990
CHICAGO	-	-

LATTICE STRUCTURE

CHICAGO 1986

<u>TASK</u>	<u>SUCCESSORS</u>							
TEXEC	DINIT1 ALTRK1	TROUT1 MSAW1	DINIT2 SWABS1	TROUT2 DABC2	CA1 TPRED2	CA2 ALTRK2	DABC1 MSAW2	TPRED1 SWABS2
TUD	CRIT	IFO	AUT	SLINK	TPRED1	SWABS1	TPRED2	SWABS2
TUDS	DINIT1 ALTRK1	TROUT1 MSAW1	DINIT2 SWABS1	TROUT2 DABC2	CA1 TPRED2	CA2 ALTRK2	DABC1 MSAW2	TPRED1 SWABS2
TUDX	CA1	CA2						
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	DINIT1	TROUT1	DINIT2	TROUT2				
IFO	IFI							
DINIT1	MAT							
DINIT2	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	RTDOP	TDOP2	TDOP3				
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATR1	CATU						
CATR1								
CA2	CATR2	CATU						
CATR2								
TPRED1								
SWABS1								

LATTICE STRUCTURE
CHICAGO 1986 (Cont'd.)

<u>TASK</u>	<u>SUCCESSORS</u>
TPRED2	
SWABS2	
DABC1	
MSAW1	
ALTRK1	
DABC2	
MSAW2	
ALTRK2	
AUT	
SLINK	
CATU	
PAUS1	
PAUS2	
PAUS3	
PAUS4	
PAUS5	*INHIBITED*
PAUS6	*INHIBITED*
PAUS7	*INHIBITED*
SCTME1	
SCTME2	
SCTME3	

LATTICE STRUCTURE
CHICAGO 1988

<u>TASK</u>	<u>SUCCESSORS</u>							
TEEXEC	DINIT1 ALTRK1	TROUT1 MSAW1	DINIT2 SWABS1	TROUT2 DABC2	CA1 TPRED2	CA2 ALTRK2	DABC1 MSAW2	TPRED1 SWABS2
TUD	CRIT	IFO	AUT	SLINK	TPRED1	SWABS1	TPRED2	SWABS2
TUDS	DINIT1 ALTRK1	TROUT1 MSAW1	DINIT2 SWABS1	TROUT2 DABC2	CA1 TPRED2	CA2 ALTRK2	DABC1 MSAW2	TPRED1 SWABS2
TUDX	CA1	CA2						
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	DINIT1	TROUT1	DINIT2	TROUT2				
IFO	IFI							
DINIT1	MAT							
DINIT2	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	RTDOP	TDOP2	TDOP3				
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1								
CA2	CATRK2	CATU						
CATRK2								
TPRED1								
SWABS1								

LATTICE STRUCTURE
CHICAGO 1988 (Cont'd.)

TASK

SUCCESSORS

TPRED2
SWABS2
DABC1
MSAW1
ALTRK1
DABC2
MSAW2
ALTRK2
AUT
SLINK
CATU
PAUS1
PAUS2
PAUS3
PAUS4
PAUS5
PAUS6
PAUS7
SCTME1
SCTME2
SCTME3

INHIBITED
INHIBITED
INHIBITED

LATTICE STRUCTURE

CHICAGO 1990

<u>TASK</u>	<u>SUCCESSORS</u>							
TEEXEC	DINIT1 ALTRK1	TROUT1 MSAW1	DINIT2 SWABS1	TROUT2 DABC2	CA1 TPRED2	CA2 ALTRK2	DABC1 MSAW2	TPRED1 SWABS2
TUD	CRIT	IFO	AUT	SLINK	TPRED1	SWABS1	TPRED2	SWABS2
TUDS	DINIT1 ALTRK1	TROUT1 MSAW1	DINIT2 SWABS1	TROUT2 DABC2	CA1 TPRED2	CA2 ALTRK2	DABC1 MSAW2	TPRED1 SWABS2
TUDX	CA1	CA2						
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	DINIT1	TROUT1	DINIT2	TROUT2				
IFO	IFI							
DINIT1	MAT							
DINIT2	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	RTDOP	TDOP2	TDOP3				
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP3	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1								
CA2	CATRK2	CATU						
CATRK2								
TPRED1								
SWABS1								

LATTICE STRUCTURE
CHICAGO 1990 (Cont'd.)

TASK

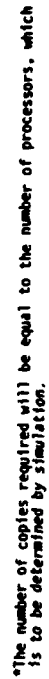
SUCCESSORS

TPRED2
SWABS2
DABC1
MSAW1
ALTRK1
DABC2
MSAW2
ALTRK2
AU1
SLINK
CATU
PAUS1
PAUS2
PAUS3
PAUS4
PAUS5
PAUS6
PAUS7
SCTME1
SCTME2
SCTME3

INHIBITED
INHIBITED
INHIBITED

APPENDIX O

LATTICE DESCRIPTIONS FOR THE LOS ANGELES TRACON



LOS ANGELES - 1982

LATTICE STRUCTURE
LOS ANGELES 1982

<u>TASK</u>	<u>SUCCESSORS</u>							
TEXEC	TINIT1 TEDC1 TEDC2	TROUT1 TPRED1 TPRED2	TINIT2 TPUR1 TPUR2	TROUT2 ALTRK1 ALTRK2	CA1 MSAW1 MSAW2	CA2 SWABS1 SWABS2	TPSEC1 TPSEC2	TCRSS1 TCRSS2
TUD	CRIT TPUR2	IFO SWABS2	AUT	SLINK	TPRED1	TPUR1	SWABS1	TPRED2
TUDS	TINIT1 TEDC1 TEDC2	TROUT1 TPRED1 TPRED2	TINIT2 TPUR1 TPUR2	TROUT2 ALTRK1 ALTRK2	CA1 MSAW1 MSAW2	CA2 SWABS1 SWABS2	TPSEC1 TPSEC2	TCRSS1 TCRSS2
TUDX	CA1	CA2						
DOP								
CDR								
PDOP								
CRIT	TINIT1	TROUT1	TINIT2	TROUT2				
IFO	IFI							
TINIT1	MAT							
TINIT2	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	TDOP2						
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1								
CA2	CATRK2	CATU						
CATRK2								
TPRED1								
SWABS1								
TPUR1								
TPRED2								
SWABS2								
TPUR2								
TCRSS1								

LATTICE STRUCTURE
LOS ANGELES 1982 (Cont'd.)

TASK

SUCCESSORS

TEDC1
TPSEC1
MSAW1
ALTRK1
TCRSS2
TEDC2
TPSEC2
MSAW2
ALTRK2
AUT
SLINK
CATU
PAUS1
PAUS2
PAUS3
PAUS4
PAUS5
PAUS6
PAUS7
SCTEM1
SCTME2
SCTME3

INHIBITED
INHIBITED
INHIBITED
INHIBITED



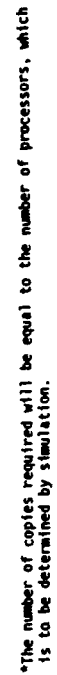
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LATTICE STRUCTURE
LOS ANGELES 1984

<u>TASK</u>	<u>SUCCESSORS</u>							
TEXEC	TINIT1 TEDC1 TEDC2	TROUT1 TPRED1 TPRED2	TINIT2 TPUR1 TPUR2	TROUT2 ALTRK1 ALTRK2	CA1 MSAW1 MSAW2	CA2 SWABS1 SWABS2	TPSEC1 TPSEC2	TCRSS1 TCRSS2
TUD	CRIT TPUR2	IFO SWABS2	AUT	SLINK	TPRED1	TPUR1	SWABS1	TPRED2
TUDS	TINIT1 TEDC1 TEDC2	TROUT1 TPRED1 TPRED2	TINIT2 TPUR1 TPUR2	TROUT2 ALTRK1 ALTRK2	CA1 MSAW1 MSAW2	CA2 SWABS1 SWABS2	TPSEC1 TPSEC2	TCRSS1 TCRSS2
TUDX	CA1	CA2						
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	TINIT1	TROUT1	TINIT2	TROUT2				
IFO	IFI							
TINIT1	MAT							
TINIT2	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	RTDOP	TDOP2					
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1								
CA2	CATRK2	CATU						
CATRK2								
TPRED1								

LATTICE STRUCTURE
LOS ANGELES 1984 (Cont'd.)

<u>TASK</u>	<u>SUCCESSORS</u>
SWABS1	
TPUR1	PUTT1
PUTT1	
TPRED2	
SWABS2	
TPUR2	PUTT2
PUTT2	
TCRSS1	
TEDC1	
TPSEC1	
MSAW1	
ALTRK1	
TCRSS2	
TEDC2	
TPSEC2	
MSAW2	
ALTRK2	
AUT	
SLINK	
CATU	
PAUS1	
PAUS2	
PAUS3	
PAUS4	
paus5	*INHIBITED*
PAUS6	*INHIBITED*
PAUS7	*INHIBITED*
SCTME1	
SCTME2	
SCTME3	



*The number of copies required will be equal to the number of processors, which is to be determined by simulation.

LATTICE STRUCTURE
LOS ANGELES 1986

<u>TASK</u>	<u>SUCCESSORS</u>							
TEEXEC	DINIT1 ALTRK1	TROUT1 MSAW1	DINIT2 SWABS1	TROUT2 DABC2	CA1 TPRED2	CA2 ALTRK2	DABC1 MSAW2	TPRED1 SWABS2
TUD	CRIT	IFO	AUT	SLINK	TPRED1	SWABS1	TPRED2	SWABS2
TUDS	DINIT1 ALTRK1	TROUT1 MSAW1	DINIT2 SWABS1	TROUT2 DABC2	CA1 TPRED2	CA2 ALTRK2	DABC1 MSAW2	TPRED1 SWABS2
TUDX	CA1	CA2						
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	DINIT1	TROUT1	DINIT2	TROUT2				
IFO	IFI							
DINIT1	MAT							
DINIT2	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	RTDOP	TDOP2					
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATR1	CATU						
CATR1								
CA2	CATR2	CATU						
CATR2								
TPRED 1								
SWABS1								
TPRED2								
SWABS2								
DABC1								

LATTICE STRUCTURE
LOS ANGELES 1986 (Cont'd.)

<u>TASK</u>	<u>SUCCESSORS</u>
MSAW1	
ASLTRK1	
DABC2	
MSAW2	
ALTRK2	
AUT	
SLINK	
CATU	
PAUS1	
PAUS2	
PAUS3	
PAUS4	
PAUS5	*INHIBITED*
PAUS6	*INHIBITED*
PAUS7	*INHIBITED*
SCTME1	
SCTME2	
SCTME3	

LATTICE STRUCTURE
LOS ANGELES 1988

<u>TASK</u>	<u>STRUCTURE</u>							
TEXEC	DINIT1 ALTRK1	TROUT1 MSAW1	DINIT2 SWABS1	TROUT2 DABC2	CA1 TPRED2	CA2 ALTRK2	DABC1 MSAW2	TPRED1 SWABS2
TUD	CRIT	IFO	AUT	SLINK	TPRED1	SWABS1	TPRED2	SWABS2
TUDS	DINIT1 ALTRK1	TROUT1 MSAW1	DINIT2 SWABS1	TROUT2 DABC2	CA1 TPRED2	CA2 ALTRK2	DABC1 MSAW2	TPRED1 SWABS2
TUDX	CA1	CA2						
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	DINIT1	TROUT1	DINIT2	TROUT2				
IFO	IFI							
DINIT1	MAT							
DINIT2	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	RTDOP	TDOP2					
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1								
CA2	CATRK2	CATU						
CATRK2								
TPRED1								
SWABS1								
TPRED2								
SWABS2								
DABC1								

LATTICE STRUCTURE
LOS ANGELES 1988 (Cont'd.)

<u>TASK</u>	<u>SUCCESSORS</u>
MSAW1	
ALTRK1	
DABC2	
MSAW2	
ALTRK2	
AUT	
SLINK	
CATU	
PAUS1	
PAUS2	
PAUS3	
PAUS4	
PAUS5	*INHIBITED*
PAUS6	*INHIBITED*
PAUS7	*INHIBITED*
SCTME1	
SCTME2	
SCTME3	

LATTICE STRUCTURE
LOS ANGELES 1990

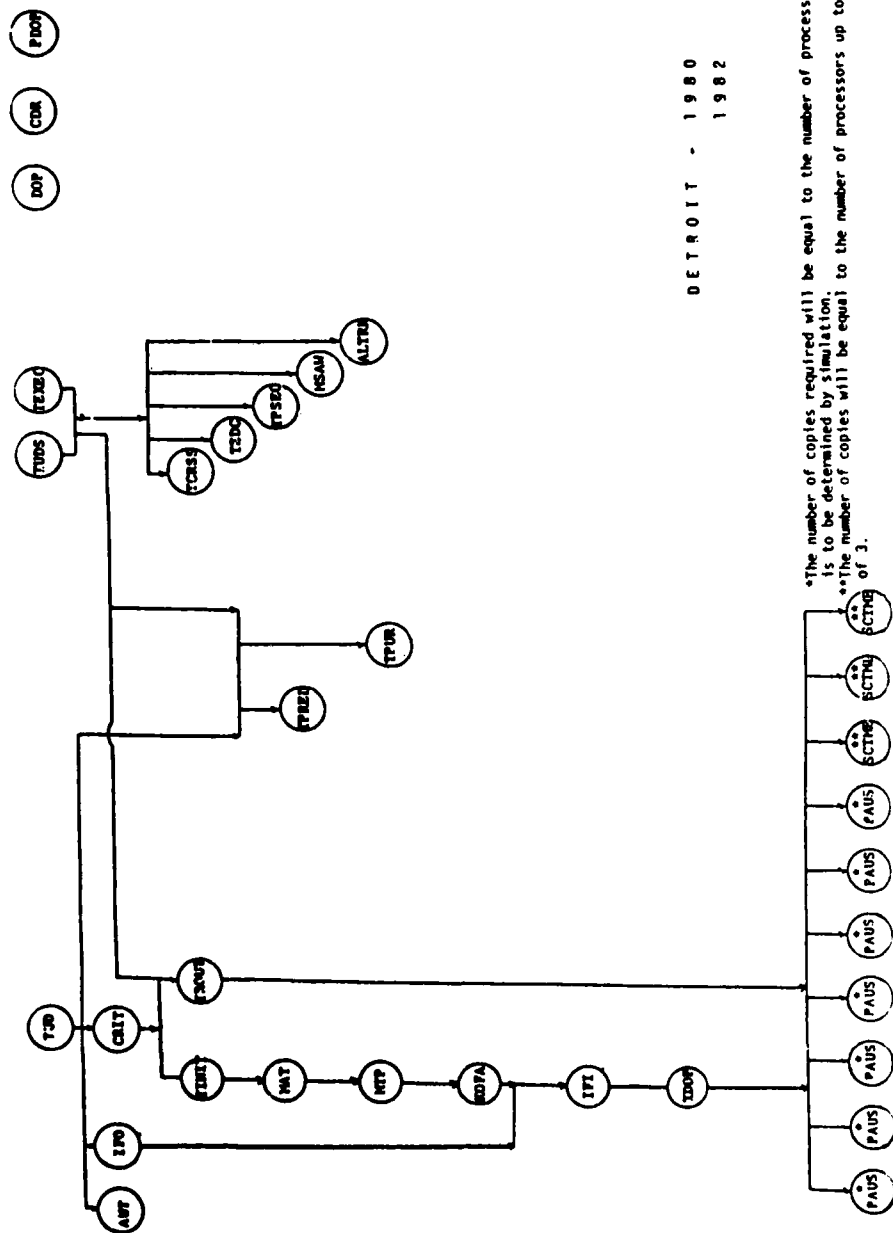
<u>TASK</u>	<u>SUCCESSORS</u>							
TEEXEC	DINIT1 ALTRK1	TROUT1 MSAW1	DINIT2 SWABS1	TROUT2 DABC2	CA1 TPRED2	CA2 ALTRK2	DABC1 MSAW2	TPRED1 SWABS2
TUD	CRIT	IFO	AUT	SLINK	TPRED1	SWABS1	TPRED2	SWABS2
TUDS	DINIT1 ALTRK1	TROUT1 MSAW1	DINIT2 SWABS1	TROUT2 DABC2	CA1 TPRED2	CA2 ALTRK2	DABC1 MSAW2	TPRED1 SWABS2
TUDX	CA1	CA2						
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	DINIT1	TROUT1	DINIT2	TROUT2				
IFO	IFI							
DINIT1	MAT							
DINIT2	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TROUT2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	RTDOP	TDOP2					
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TDOP2	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1								
CA2	CATRK2	CATU						
CATRK2								
TPRED1								
SWABS1								
TPRED2								
SWABS2								
DABC1								

LATTICE STRUCTURE
LOS ANGELES 1990 (Cont'd.)

<u>TASK</u>	<u>SUCCESSORS</u>
MSAW1	
ALTRK1	
DABC2	
MSAW2	
ALTRK2	
AUT	
SLINK	
CATU	
PAUS1	
PAUS2	
PAUS3	
PAUS4	
PAUS5	*INHIBITED*
PAUS6	*INHIBITED*
PAUS7	*INHIBITED*
SCTME1	
SCTME2	
SCTME3	

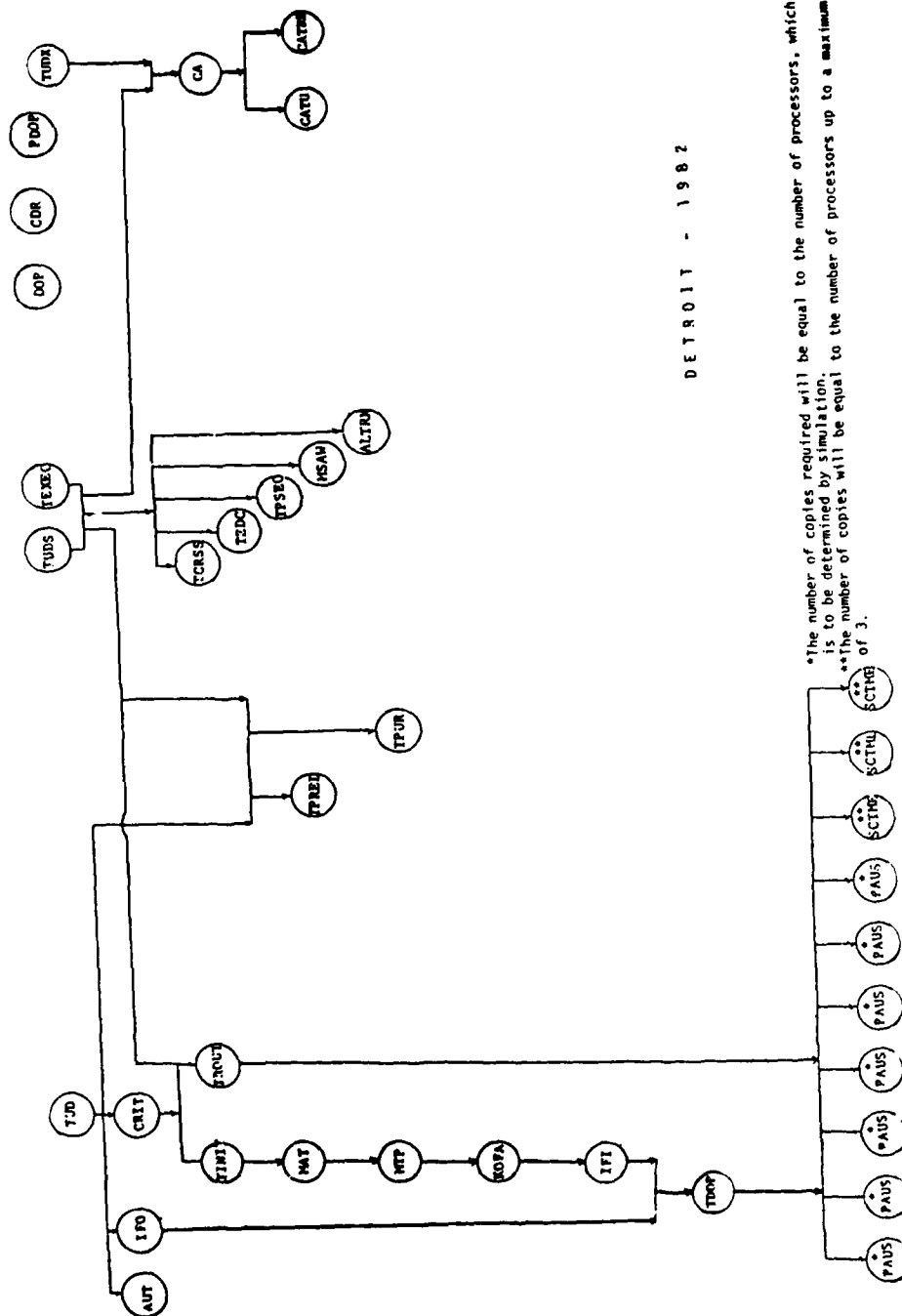
APPENDIX P

LATTICE DESCRIPTIONS FOR THE DETROIT TRACON

DETROIT - 1980
1982

LATTICE STRUCTURE
DETROIT 1980

<u>TASK</u>	<u>SUCCESSORS</u>							
TEXEC	TINIT1 MSAW1	TROUT1	TPSEC1	TCRSS1	TPRED1	TPUR1	ALTRK1	
TUD	CRIT	IFO	AUT	TPRED1	TPUR1			
TUDS	TINIT1 MSAW1	TROUT1	TPSEC1	TCRSS1	TEDC1	TPRED1	TPUR1	ALTRK1
DOP								
CDR								
PDOP								
CRIT	TINIT1	TROUT1						
IFO	IFI							
TINIT1	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1							
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
TPRED1								
TPUR1								
TCRSS1								
TEDC1								
TPSEC1								
MSAW1								
ALTRK1								
AUT								
PAUS1								
PAUS2	*INHIBITED*							
PAUS3	*INHIBITED*							
PAUS4	*INHIBITED*							
PAUS5	*INHIBITED*							
PAUS6	*INHIBITED*							
PAUS7	*INHIBITED*							
SCTME1								
SCTME2	*INHIBITED*							
SCTME3	*INHIBITED*							

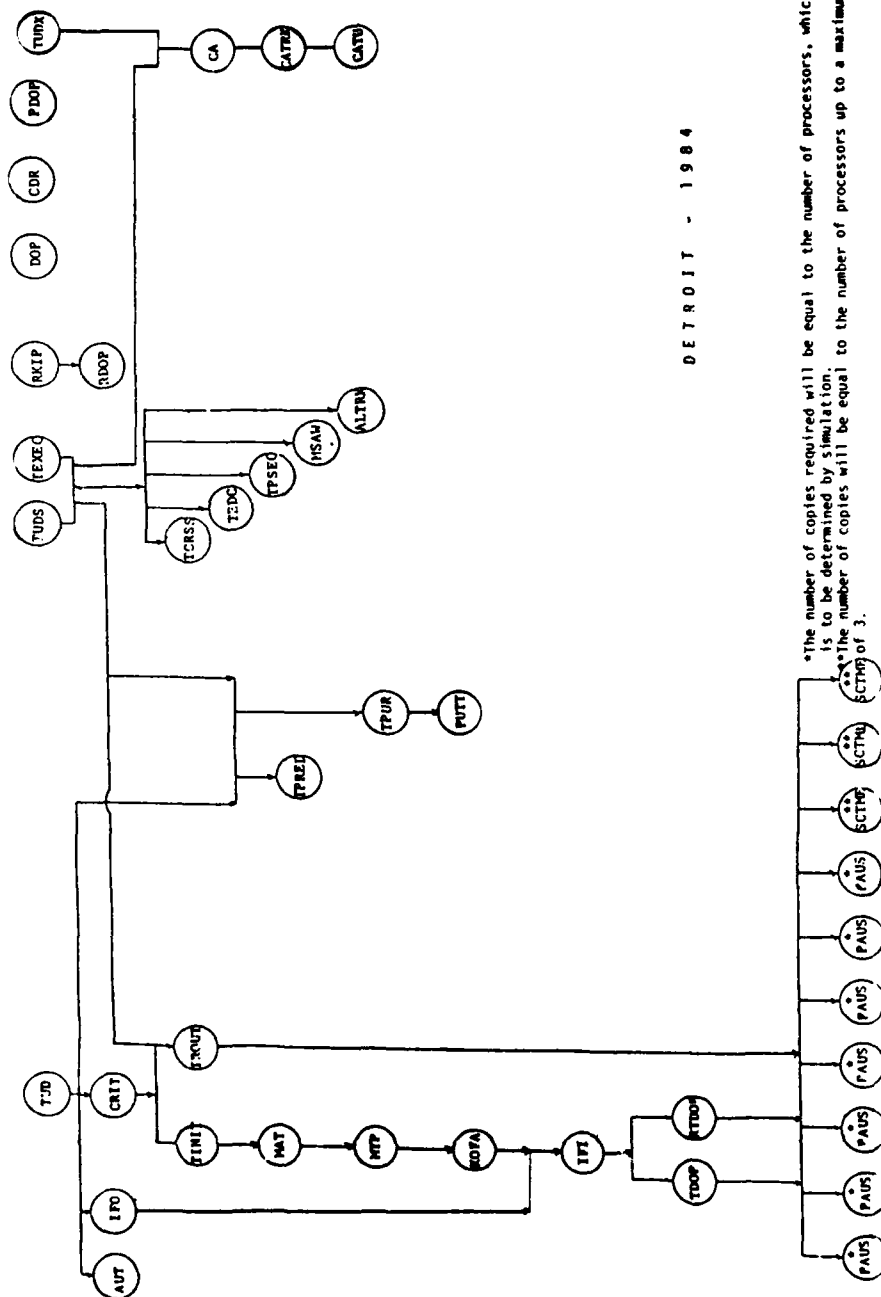


DETROIT - 1982

*The number of copies required will be equal to the number of processors, which is to be determined by simulation.
 **The number of copies will be equal to the number of processors up to a maximum of 3.

LATTICE STRUCTURE
DETROIT 1982

<u>TASK</u>	<u>SUCCESSORS</u>							
TEXEC	TINIT1 ALTRK1	TROUT1 MSAW1	CA1	TPSEC1	TCRSS1	TEDC1	TPRED1	TPUR1
TUD	CRIT	IFO	AUT	TPRED1	TPUR1			
TUDS	TINIT1 ALTRK1	TROUT1 MSAW1	CA1	TPSEC1	TCRSS1	TEDC1	TPRED1	TPUR1
TUDX	CA1							
DOP								
CDR								
PDOP								
CRIT	TINIT1	TROUT1						
IFO	IFI							
TINIT1	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1							
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1								
TPRED1								
TPUR1								
TCRSS1								
TEDC1								
TPSEC1								
MSAW1								
ALTRK1								
AUT								
CATU								
PAUS1								
PAUS2								
PAUS3								
PAUS4	*INHIBITED*							
PAUS5	*INHIBITED*							
PAUS6	*INHIBITED*							
PAUS7	*INHIBITED*							
SCTME1								
SCTME2								
SCTME3								



DETROIT - 1984

LATTICE STRUCTURE
DETROIT 1984

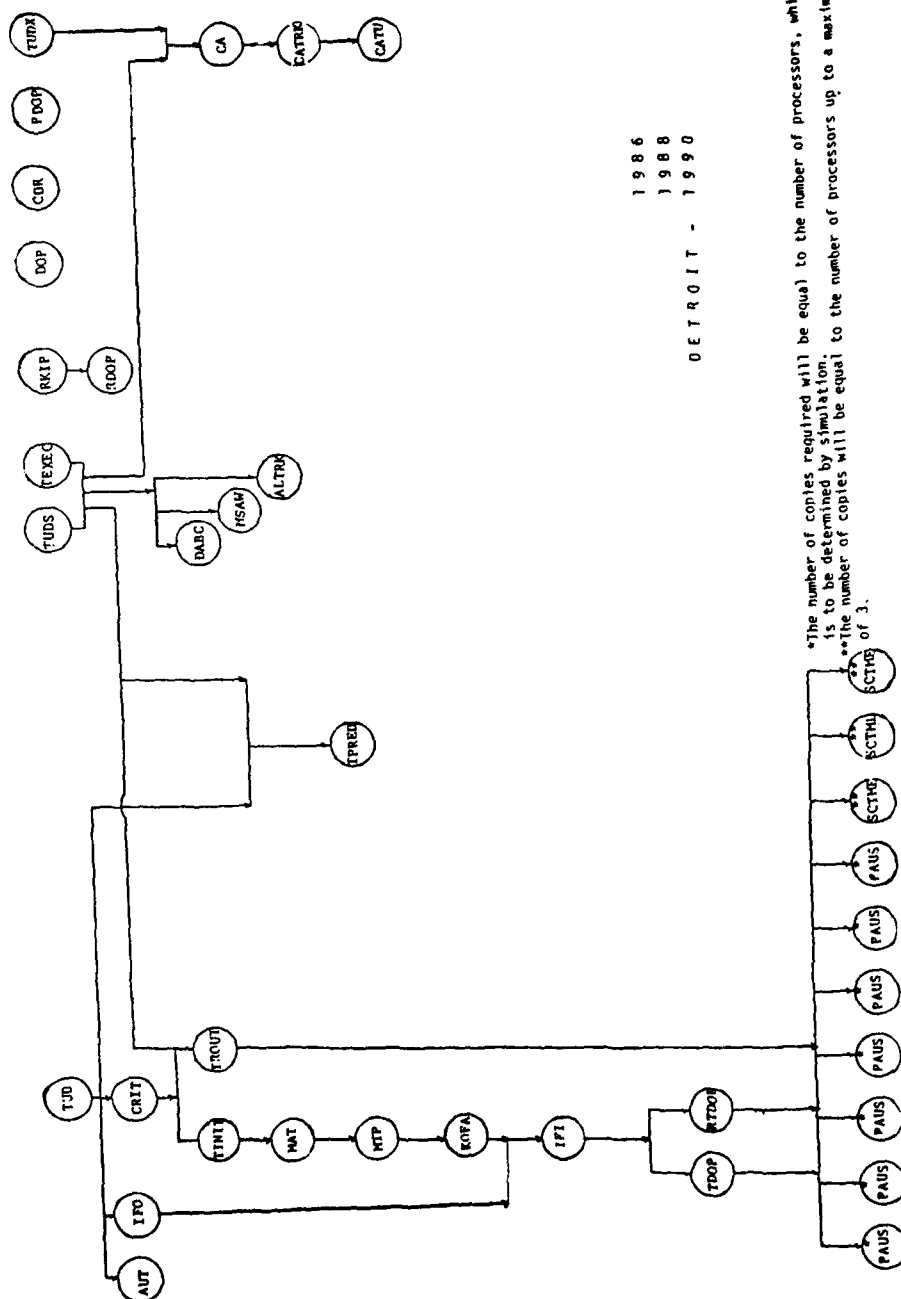
<u>TASK</u>	<u>SUCCESSORS</u>							
TExec	TINIT1 ALTRK1	TROUT1 MSAW1	CA1	TPSEC1	TCRSS1	TEDC1	TPRED1	TPUR1
TUD	CRIT	IFO	AUT	TPRED1	TPUR1			
TUDS	TINIT1 ALTRK1	TROUT1 MSAW1	CA1	TPSEC1	TCRSS1	TEDC1	TPRED1	TPUR1
TUDX	CA1							
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	TINIT1	TROUT1						
IFO	IFI							
TINIT1	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	RTDOP						
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1								
TPRED1								
TPUR1	PUTT1							
PUTT1								
TCRSS1								
TEDC2								
TPSEC1								
MSAW1								
ALTRK1								
AUT								
CATU								
PAUS1								
PAUS2								
PAUS3								

LATTICE STRUCTURE
DETROIT 1984 (Cont'd.)

TASK

SUCCESSORS

PAUS4	*INHIBITED*
PAUS5	*INHIBITED*
PAUS6	*INHIBITED*
PAUS7	*INHIBITED*
SCTME1	
SCTME2	
SCTME3	



1986
1988
1990

LATTICE STRUCTURE
DETROIT 1986

<u>TASK</u>	<u>SUCCESSORS</u>							
TEEXEC	DINIT1	TROUT1	CA1	DABC1	TPRED1	ALTRK1	MSAW1	
TUD	CRIT	IFO	AUT	TPRED1	TPUR1			
TUDS	DINIT1	TROUT1	CA1	DABC1	TPRED1	ALTRK1	MSAW1	
TUDX	CA1							
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	DINIT1	TROUT1						
IFO	IFI							
DINIT1	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	RTDOP						
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1								
TPRED1								
DARC1								
MSAW1								
ALTRK1								
AUT								
CATU								
PAUS1								
PAUS2								
PAUS3								
PAUS4	*INHIBITED*							
PAUS5	*INHIBITED*							
PAUS6	*INHIBITED*							
PAUS7	*INHIBITED*							
SCTME1								
SCTME2								
SCTME3								

LATTICE STRUCTURE
DETROIT 1988

<u>TASK</u>	<u>SUCCESSORS</u>							
TExec	DINIT1	TROUT1	CA1	DABC1	TPRED1	ALTRK1	MSAW1	
TUD	CRIT	IFO	AUT	TPRED1	TPUR1			
TUDS	DINIT1	TROUT1	CA1	DABC1	TPRED1	ALTRK1	MSAW1	
TUDX	CA1							
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	DINIT1	TROUT1						
IFO	IFI							
DINIT1	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	RTDOP						
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1								
TPRED1								
DABC1								
MSAW1								
ALTRK1								
AUT								
CATU								
PAUS1								
PAUS2								
PAUS3								
PAUS4								
PAUS5	*INHIBITED*							
PAUS6	*INHIBITED*							
PAUS7	*INHIBITED*							
SCTME1								
SCTME2								
SCTME3								

LATTICE STRUCTURE
DETROIT 1990

<u>TASK</u>	<u>SUCCESSORS</u>							
TEEXEC	DINIT1	TROUT1	CA1	DABC1	TPRED1	ALTRK1	MSAW1	
TUD	CRIT	IFO	AUT	TPRED1	TPUR1			
TUDS	DINIT1	TROUT1	CA1	DABC1	TPRED1	ALTRK1	MSAW1	
TUDX	CA1							
RKIP	RDOP							
RDOP								
DOP								
CDR								
PDOP								
CRIT	DINIT1	TROUT1						
IFO	IFI							
DINIT1	MAT							
TROUT1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
MAT	MTP							
MTP	KOFA							
KOFA	IFI							
IFI	TDOP1	RTDOP						
TDOP1	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
RTDOP	PAUS1 SCTME2	PAUS2 SCTME3	PAUS3	PAUS4	PAUS5	PAUS6	PAUS7	SCTME1
CA1	CATRK1	CATU						
CATRK1								
TPRED1								
DARC1								
MSAW1								
ALTRK1								
AUT								
CATU								
PAUS1								
PAUS2								
PAUS3								
PAUS4								
PAUS5	*INHIBITED*							
PAUS6	*INHIBITED*							
PAUS7	*INHIBITED*							
SCTME1								
SCTME2								
SCTME3								

APPENDIX Q

REFERENCES

REFERENCES

1. Engineering and Development Program Plan - Terminal/Tower Control, FAA-ED-14-2A, Federal Aviation Administration, November 1978.
2. ARTS IIIA Systems Design Data, ATC 2300, Sperry UNIVAC Defense Systems, December 1977.
3. ATC Hardware Design Data, ATC 2100, Sperry UNIVAC Defense Systems, May 1977.
4. Metering and Spacing - ARTS III Design Data, PX 11123, Revision 4, Sperry UNIVAC Defense Systems, April 1979.
5. Terminal Information Processing System (TIPS) Preliminary Design Data, Lockheed Electronics Company, June 1979.
6. DABS/SRAP II/ARTS III Design Data, ATC 10300, Revision B Sperry UNIVAC Defense Systems, November 1978.
7. ARTS Multiprocessor Executive Simulation Model Detailed Description, PX 10473, Sperry UNIVAC Defense Systems, September 1974.
8. Remote Display Buffer Memory Design Data Document, ATC 10704, Sperry UNIVAC Defense Systems, April 1978.
9. Definition, Description, and Interfaces of the FAA's Developmental Programs, FAA-EM-78-16, II, Federal Aviation Administration, September 1978.
10. Preliminary Tower Automated Ground Surveillance (TAGS) Operational System Definition, MTR-7153, MITRE Corporation, February 1976.
11. Airport/Facility Directory, National Oceanographic and Atmospheric Administration, September 1978.
12. Terminal Area Forecasts Fiscal Years 1979-1990, FAA-AVP-78-6, Federal Aviation Administration, June 1978.
13. FAA Air Traffic Activity Peak Day and Terminal Area Relationships Calendar Year 1973, Federal Aviation Administration, February 1974.
14. FAA Air Traffic Activity Fiscal Year and Calendar Year 1972, Federal Aviation Administration, June 1973.
15. Air Traffic Activity Terminal Area Relationships Fiscal Year 1976, Federal Aviation Administration, March 1977.

16. FAA Air Traffic Activity Fiscal Year 1977, Federal Aviation Administration, September 1977.
17. Military Air Traffic Activity Report Calendar Year 1976, Federal Aviation Administration.
18. Metering and Spacing Design Data - ARTS III, UNIVAC, April 1979 (PX 11123, Rev. 4)
19. Terminal Information System: ARTS III Input/Output Requirements, MITRE, November 1976 (MTR - 7161)
20. Terminal Information System ER (FAA-ER-D-120-006)
21. Tower Automated Ground Surveillance System (TAGS) Alternatives Study, MITRE, January 1979 (MTR-79W00017)
22. Full Digital ARTS Display (FDAD) ER, FAA-ER-D-120-007
23. ARTS III - ARTS IIIA - EARTS - NYTRACON Site Configurations, Sperry UNIVAC Defense Systems, November 1977.
24. Excerpts from PRIMARY/SECONDARY TERMINAL RADAR SITING HANDBOOK, Order 6310.6, July 1976.
25. Terminal Area Air Traffic Relationships Fiscal Year 1971. Federal Aviation Administration, December 1971..
26. Tower Airport Statistics Handbook Calendar Year 1977, FAA-AVP-78-10, Federal Aviation Administration, July 1978.
27. Location Identifiers, Order 7350.4N, Federal Aviation Administration, September 1978.
28. Design Data for Conflict Alert Stage 1, UNIVAC, Dec' 76 Rev. May 1977 (ATC 10410)
29. Terminal Area Conflict Alert Design Verification Test Results, MITRE, January 1978 (MTR-7677).
30. Terminal Area Conflict Alert: Design Evaluation Test Results for ARTS III Dual Beacon Sites, MITRE, September 1978 (MTR-7928).

APPENDIX R
GLOSSARY OF TERMS

GLOSSARY OF TERMS

<u>Task</u>	<u>Definition</u>
ADB	Altitude Data Blocks
ALTRK	Altitude Tracker
AT	Associated Tracks requiring Display Change
ATB	Associated Tracks with Beacon Codes
ATC	Associated Tracks with Mode C
ATD	Associated Tracks with Discrete Beacon
ATH	Associated Tracks in Handoff
AUT	Automatic Offset of Display Data Blocks
BANS	Brite Alpha Numeric System
BOR	Beacon Only Reports
BOT	Beacon Only Tracking Table
CA	Conflict Alert
CATRK	CA Tracking
CATU	CA Data Base Manager
CCT	Number of Changes to CTS Threads
CDR	Continuous Data Recording
CDT	Console Data Terminal
CMA	Central Memory Access
CMC	Communications Multiplexer Controller
CRIT	Critical Data Recording
CTA	Associated Tracks for Mode C Beacon Equipped Aircraft, Plus Unassociated Linked Tracks
CTS	Central Track Store
DABS	Discrete Address Beacon System
DEDS	Data Entry and Display System
DOP	Display Output Processing
DSPL	Quantity of Displays
DTT	Deviation Trial Tracks
EDISC	Disk Control
FD	Full Data Blocks requiring Display Change
FDAD	Full Digital ARTS Display
IAC	Instantaneous Airborne Count
IFI	Interfacility Input

GLOSSARY OF TERMS (cont'd)

<u>Task</u>	<u>Definition</u>
IFO	Interfacility Output
IOP	Input Output Processor
KOFA	Keyboard Operational Functions
LD	Limited Data Blocks requiring Display Change
MAT	Flight Plan Tab List Data Monitor
MD	MSAW Data Blocks requiring Display Change
MDBM	Multiplexed Display Buffer Memory
MOP	Map Output Processing
MPE	Multiprocessor Executive
M&S	Terminal Metering and Spacing
MSAW	Minimum Safe Altitude Warning
MSP	Medium Speed Printer Control
MSPOP	Metering and Spacing Popup Task
MTP	Magentic Tape Processing
NAT	Number of Associated Threads Updated
NCS	Number of Changes to Sector Threads
NDT	Number of Tracks Flagged for Delay Terminations
NM	Number of Tracks in the MSAW Tab List
NPC	Number of Tracks in the Coast/Suspend List
NPS	Tracks in the Store List
NT	Number of Tracks, Total
NTT	Tabular Lines
PAUS	Track Display Data Output Control
PDOP	Periodic Display Output Processing
PSRAP	SRAP Input Processing
PUTT	Process Untracked Targets
RAT	Radar Address Table
RDBM	Remote Display Buffer Memory
RDOP	Remote Display Output Processing
RFDU	Reconfiguration and Fault Detection Unit
RKIP	Remote Keyboard Input Processing
ROR	Radar Only Reports
ROT	Radar Only Tracking Table
RRR	Radar Reinforced Beacon Reports

GLOSSARY OF TERMS (cont'd)

<u>Task</u>	<u>Definition</u>
RTDOP	Remote Tabular Display Output Processing
SCTME	Scratch Pad Display Monitor
SEC	Sector Number of given Sensor
SLINK	Inter-Sensor Track Link
SNS	Sensor Number
SNSR	Quantity of Sensors
SRAP	Sensor Receiver and Processor
SS	Single Symbols requiring Display Update
SWABS	Software Adaption to Beacon System
T	Total Tracks
TA	Associated Tracks - Total
TAA	Number of Associated Threads Added
TAD	Number of Associated Tracks Displays
TAF	Number of Associated Tracks requiring a FDB Update
TCDD	Tower Cab Digital Display
TCRSS	Track Cross Reference
TDOP	Tabular Display Output Processing
TEDC	Track Early Discrete Correlation
TEEXEC	Tracking Executive
TINIT	Track Initialization
TIPS	Terminal Information Processing System
TL	Tabular Lines requiring Display Update
TO	Number of Threads Added/Deleted
TPRED	Track Prediction
TPSEC	Primary/Secondary Correlation
TPUR	Process Unused Reports
TROUT	Track Output
TSL	Number of Tracks in the Store List
TSS	Number of Tracks requiring Single Symbol Updates
TTT	Turning Trial Tracks
TU	Number of Unassociated Tracks, Total
TUD	Thread Update
TUDS	Sector Thread Update
TUDX	Thread Update for Conflict Alert

GLOSSARY OF TERMS (cont'd)

<u>Task</u>	<u>Definition</u>
TUF	Number of Unassociated Tracks requiring FDB Update
TUL	Unassociated Linked Tracks, Total
TUU	Unassociated Unlined Tracks, Total
UBR	Unused Beacon Reports
URR	Unused Radar Reports
UT	Unassociated Tracks, requiring Display Update
UTB	Unassociated Tracks, Beacon
UTC	Unassociated Tracks, Mode C
UTD	Unassociated Tracks, Discrete Beacon
UTL	Unassociated Tracks requiring LDB Update

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